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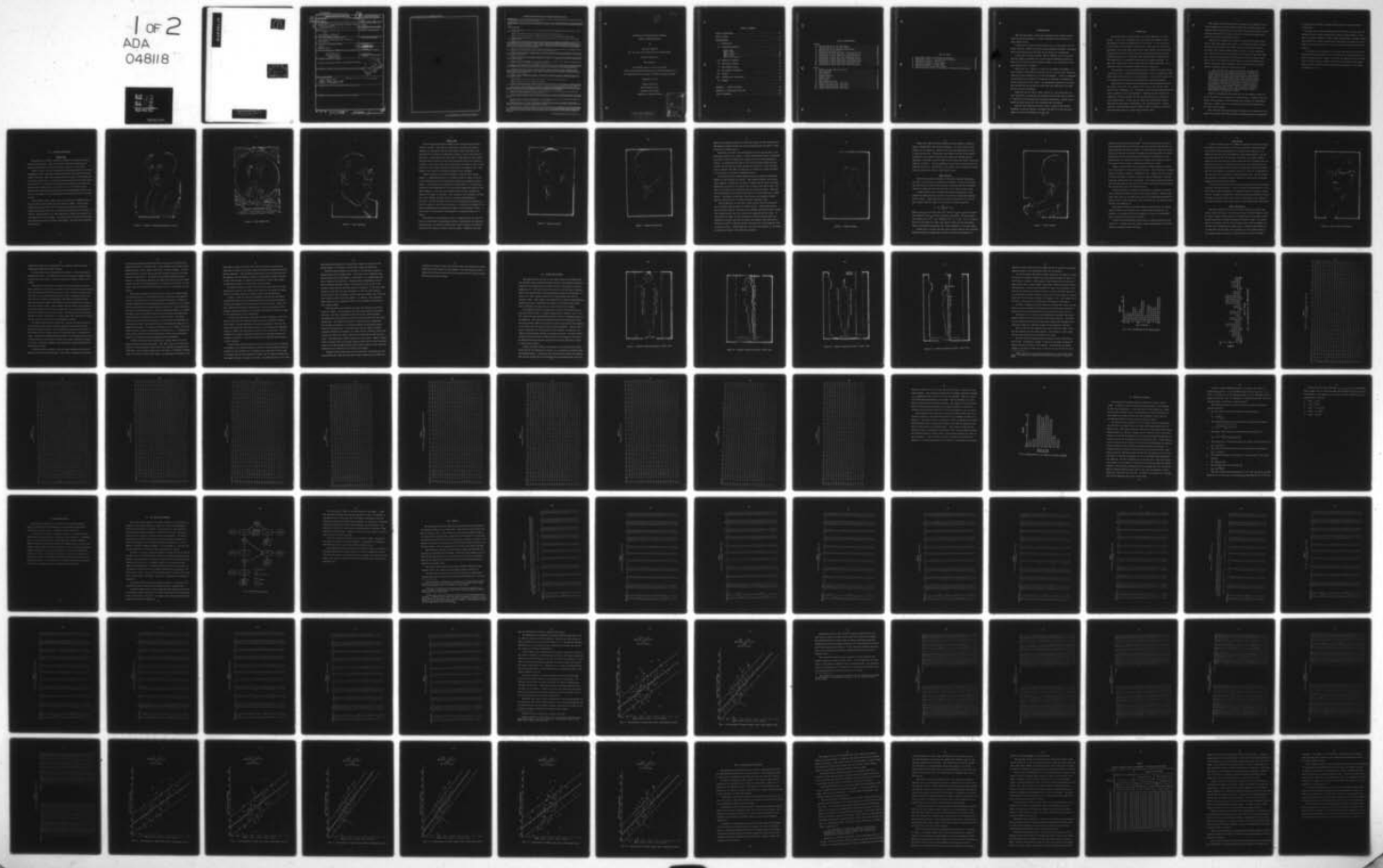

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Estimation of Stature from the Vertebral Column of American Negroes

By

Gary Lynn Tibbetts

B.S. June 1971, The United States Air Force Academy

A Thesis submitted to

The Faculty of

The Graduate School of Arts and Sciences

of The George Washington University in partial satisfaction of

the requirements for the degree of Master of Forensic Science

September 30, 1977

Thesis directed by

Charles Edward O'Rear

Professor and Chairman

Department of Forensic Science

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I. INTRODUCTION

The identification of human remains is of great importance in today's society. In the case of homicidal death, the single most important clue to the murderer is often the identification of the victim. In all cases there is the family of the deceased to consider; both emotionally and financially. Emotionally, the social values which prevail today require the identification of human remains so they can be returned to the surviving family for proper disposition and burial. Financially, legal proof of death is necessary for the disposition of the deceased's estate and life insurance proceeds. In most cases, legal proof of death (in the form of a death certificate) is not obtainable unless the deceased's remains have been identified.

Unfortunately, it is not presently possible to identify all human remains, either due to lack of identifiable characteristics or due to inability to match identifiable characteristics to known individuals. It is for this reason that no information which may assist in identification should be overlooked.

Every person has identifying characteristics which distinguish him from all others, such as sex, race, height, color of eyes, color of hair, body build, scars, fingerprints, etc. Immediately after death these characteristics begin to deminish as the body decomposes. Depending upon the degree of decomposition it may be possible for even the untrained person to determine some characteristics. By the time the remains have skeletonized, however, they provide practically no information to the untrained person. In many cases even trained personnel may be misled by parts of skeletons unless they deal with human bones on a regular basis (Stewart, 1951).

The skeleton has effectively lost its identity as an individual and it is the responsibility of those persons tasked with the identification of skeletal remains to search for the clues which may provide meaningful identification characteristics. Stature is one such identifying characteristic which lends itself to additional research.

Stature can be divided into two parts, the axial (head-trunk) length and the lower limb length (Wells, 1959). A considerable amount of work has been done on the estimation of stature from the long bones of the body: the femur, tibia, fibula, humerus, radius, and ulna. On the other hand, very little has been done on the estimation of stature from the axial skeleton. The lack of such studies was mentioned by Pearson as early as 1898. Then in 1929, in an editorial note following an article on estimation of stature using Chinese data (Stevenson, 1929), Pearson made the following remarks recommending study of the vertebral column:

> If we consider the parts of the skeleton not taken into consideration, and which suggest selection, we naturally turn to the vertebral column as the most important. Of course the pelvic and cranial heights might present appreciable correlations, but the first subject for study seems to me the vertebral column. At present nobody knows the correlations between any individual vertebra and the total length of the column. It is quite possible that it might not be needful to use all the vertebrae, but that the correlation of stature with the heights of one or two vertebrae might be nearly as efficient as measuring the whole series. The investigation would be well worth while making, if the Chinese material extends to measurements on the vertebral column.

Pearson's recommendation went unnoticed, and the vertebral column has yet to be studied in this regard in the United States. In France, Fully and Pineau (1960) presented a study which partially followed the recommendation of Pearson. However, there is no indication that they were prompted by or even aware of his remarks.

Fully and Pineau developed regression formulae for the estimation of the length of the column from certain groups of vertebrae and for the estimation

of stature from the lumbar vertebrae plus the length of either the femur or the tibia.

The only other study which addressed the estimation of stature from the vertebral column had been conducted by an American, Thomas Dwight, in 1894, prior to Pearson's comments. Dwight's study utilized intact vertebral columns from cadavers and, although providing an indication of the usefulness of the column for stature estimation, is of little value when dealing with skeletal remains.

The purpose of this research is to at least partially fill this void by developing regression formulae for the estimation of stature from the vertebrae of American Negroes. Negroes were chosen for study because of the total lack of previous vertebral studies on this race, and because of the availability of Negro specimens from the Terry Anatomical Collection now located in Washington, D.C.

II. HISTORICAL BACKGROUND

Before 1889

The estimation of stature has been of interest to the physical anthropologist for many years. Most of the early studies were carried out by French anthropologists and from there spread to the rest of the world.

Orfila, (Plate 1) in 1831, conducted the first study based on the actual measurements of the long bones and constructed tables from which the stature could be predicted. These tables were based on the study of 20 skeletons and 51 cadavers of both sexes. Orfila also utilized the work of the French Anatomist, Sue (1755). Sue (Plate 2) had studied the variations in skeletal proportions due to differences of age and sex as an aid to students of art. Orfila became interested in Sue's work from the anthropological point of view after it was realized that the proportions could possibly be used to estimate stature.

After Orfila's study, similar tables were presented by Humphry (1858) in England, and by Langer (1872) and Toldt (1882) in Germany. These studies consisted of too few samples to be statistically significant and did not differentiate between the sexes. The measuring technique also left much to be desired. Topinard (Plate 3) in 1885, published an article which pointed out the weakness of Orfila's methods. He included work of his own which was much more accurate than that of previous investigators, and which dealt separately with each sex.

Plate 1 Matthieu Joseph Bonaventure Orfila

Plate 2 Jean Joseph Sue

Plate 3 Paul Topinard

1889 to 1898

One of the most significant studies in this field was done by Rollet (Plate 4) in 1889. This study was significant, not because of Rollet's findings, but because his data was later used by other investigators and would persist as a basis for estimation of stature in most of the world for many years. Rollet measured the long bones of fifty males and fifty females from the south of France, and from these constructed tables for estimation of height. During this study, Rollet measured the long bones in both a fresh state and a "dry" state and found that they shrank an average of 2mm. This figure is still used as the average shrinkage of the long bones.

Rollet's work was criticized by Manouvrier (1890 and 1892) for two reasons: 1) approximately half of his sample was over 60 years of age and 2) he constructed his table by finding the expected bone lengths for given heights. The first point was considered a problem because it was generally accepted by the anthropologists of the period that people lost height as they aged, although, at that time, no extensive studies had been conducted to determine the degree of shrinkage. The second point was considered a problem due to what Alphonse Bertillon named the "Paradoxe Anthropometrique". Manouvrier, in 1890, published an article which exemplified this paradox by using the length of the foot and the stature. He showed that a height of 1.8 meters corresponded to an expected foot length of 275 millimeters, while a foot length of 275 millimeters corresponded to an expected height of 1.71 meters.

Using Rollet's data, Manouvrier (Plate 5) compiled tables for the estimation of stature which were published in 1892, correcting the two above mentioned problems. He used only those subjects under 60 years of age leaving 24 males and 25 females on which to base his tables. Manouvrier based his

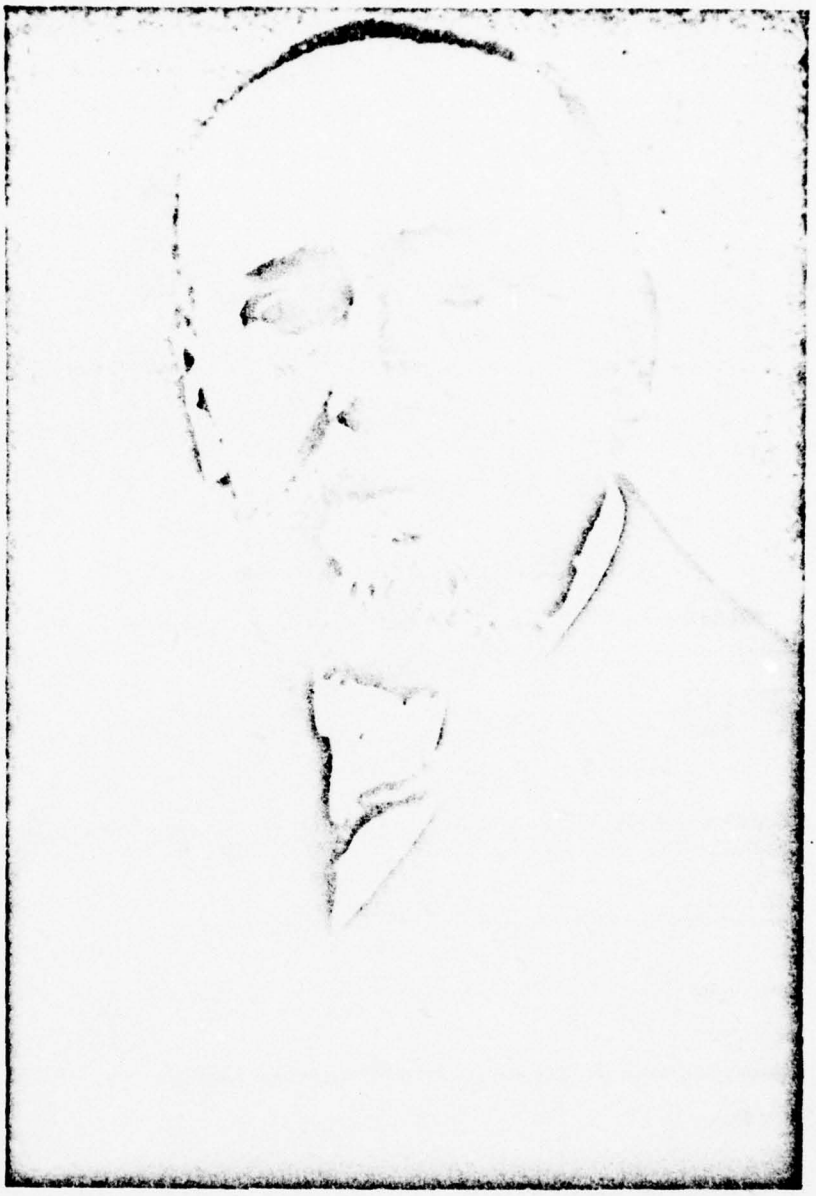

Plate 4 Etienne Rollet

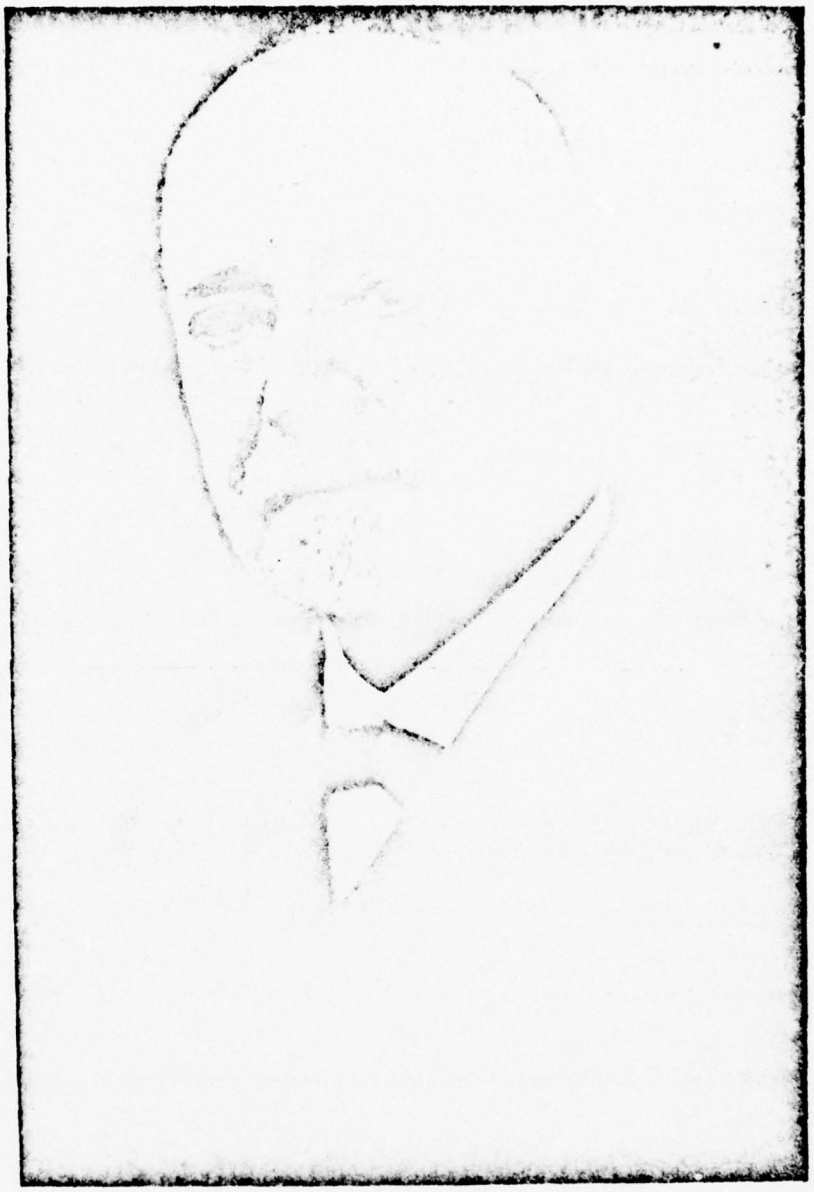

Plate 5 Leonce Manouvrier

tables on the expected height for a given bone length and also indicated that 2mm should be subtracted from the statures estimated from his tables in order to obtain the living stature.

During the late 1800's the long bones were not the only portions of the body being studied in this regard. In 1890, Thomas Dwight (Plate 6) published an article in which he explored the sternum as an aid in the estimation of stature. He added additional data to this study in another paper published in 1894, and concluded that while the typical sternum has a fairly constant ratio to heights, the number of variations is so great as to make the method of little value in estimating individual statures.

In his 1894 article, Dwight expanded on what he called the "Anatomical Method" for the estimation of stature. This method consisted, for all practical purposes, of laying out the skeleton (making sure the spine is properly proportioned and curved, and allowing for cartilage) from head to foot, measuring it and adding a few centimeters for the missing soft parts. This method is seldom practical in medico-legal cases as the entire skeleton is seldom present. The process is also quite time consuming and requires a greater amount of expertise than is normally available (Britinger, 1937).

Of more importance to the current study, however, was his introduction of a new method using the spine to estimate stature. Dwight dissected the spines from the cadavers of 56 males and 21 females and measured their straight line lengths from the top of the atlas to the promontory of the sacrum. He then divided the spine, by sex, into groups of three centimeters each and computed the average ratio of each group to the stature; thus giving him coefficients by which to multiply spines falling into any of the groups in order to estimate stature. Dwight found that, with only one exception, as the length of the spine increased, the coefficient decreased.

Plate 6 Thomas Dwight

Dwight then compared estimated heights using the methods of Topinard, Rollet, and Manouvrier with his own estimations. He used 20 males and 20 females for his comparison, although he had the spine measurements in only 17 cases for each sex. The results, when compared with the actual heights, revealed that the order of accuracy for the males was Topinard, Rollet, Manouvrier, and Dwight; while the order for the females was Dwight, Manouvrier, Topinard, and Rollet. He thus established that the spine could be used as an indicator of stature. Unfortunately, this method, like the anatomical method, does not readily lend itself to most forensic cases.

1898 - Pearson

Each of these studies attempted to reconstruct height by determining the ratio of the stature to the length of the bones. In each it was discovered that the ratio varied with the length of the bones and the researchers resorted to tabulating the ratio for three or four ranges of bone length.

In 1898, Pearson (Plate 7) applied the theory of regression to this problem and showed that the ratio the others had been seeking was dependant on bone length. Pearson showed that, if given a known organ "A", then the most probable value for organ "B" was given by the linear equation:

$$B - m_B = \frac{\sigma_B}{\sigma_A} r_{AB} (A - m_A)$$

where m_A and m_B are the mean sizes of "A" and "B"; σ_A and σ_B are their standard deviations; and r_{AB} is their correlation coefficient. He then reduced this equation to $B = c_1 + c_2 A$. Therefore, $B/A = c_2 + c_1/A$. If "B" is stature and "A" is the length of a bone, this equation shows that the ratio which previous researchers were seeking was, indeed, dependant on long bone length.

Pearson went on to show that more than one organ could be used to develop multiple regression formulae and criticized the French researchers for a

Plate 7 Karl Pearson

technique they had generally advocated. The French researchers had customarily predicted stature from several single bones and then used the mean of these predictions as the true stature. By using multiple regression, Pearson was able to show that the method of averaging several estimations of stature may actually screen out negative partial regression coefficients and that, theoretically, the regression formula for n organs will provide more valuable results than the mean of n regression formulae for n organs.

Pearson, using Rollet's data, proceeded to develop regression formulae for the estimation of stature from the long bones. Unlike Manouvrier, Pearson used all of Rollet's subjects, regardless of age. Pearson felt that a sample of only 50 was almost too small, and that it would be impossible to develop meaningful formulae from only 25 skeletons. He carefully weighed the effects that the older subjects would have on his results and decided that they would not significantly reduce the expected heights.

Pearson compared his estimates and Manouvrier's estimates of ten males and ten females from Rollet's data with the actual statures. Pearson's mean errors were 2.46cm for the males and 2.2cm for the females while Manouvrier's were 2.975 and 3.075cm respectively, thus indicating that his method was more accurate than Manouvrier's.

This study by Pearson, although primarily intended for use in anthropological studies of pre-historic races, would remain virtually the only reference to be widely used for the estimation of stature in medico-legal cases in the United States until the 1950's.

Pearson also warned against using regression formulae derived from one local race on another local race without careful consideration of the evolutionary relationship between the races.

1900 to 1950

In 1929, Stevenson (Plate 8) compared the regression formulae developed by Pearson from French cadavers with his own regression formulae developed from 48 male cadavers representative of the North China population. He found that when using the French formulae on the Chinese material, the average prediction was over 4cm too small. Conversely, the Chinese formulae applied to the French material provided predictions which averaged about the same amount too large. Stevenson pointed out that this variation was over seven times the probable error and that the probability against the formulae from one race producing a satisfactory stature estimate for an individual of the other race was on the order of several million to one. He then stressed the importance of deriving regression formulae for other races, as had been suggested by Pearson 30 years earlier.

In 1937, Breitinger conducted a massive investigation into the estimation of stature from the long bones. His data consisted of measurements on 2,400 males, most of whom participated in a gymnastics festival in Munich, Germany in 1923. Although he followed the statistical analysis introduced by Pearson, his study is of questionable value because all measurements were conducted on living individuals, thus leaving the bone length measurements questionable.

1950 to the Present

The 1950's produced a surge in the field of stature estimation which lasted through the decade. The first was a study in 1950 by Telkka in which he studied a sample of 115 males and 39 females from the collections of the Anatomy Department of Helsinki University, Helsinki, Finland. The average ages of the subjects were 42.3 for the males and 50.4 for the females, with 17 males and 11 females over 60 years of age. Telkka's study included all six long bones and disclosed little differences in the standard errors of the estimate between the bones. He also found that the use of multiple

Plate 8 Paul Huston Stevenson

regression provided little improvement over regression formulae derived from merely summing the lengths of bones.

In 1951, three articles appeared on this subject. Trotter and Gleser published two works: one dealing with the effects of age on stature (1951a) and the other with trends in stature of persons born between 1840 and 1924 (1951b).

The first of these studies was conducted on 855 skeletons of American Whites and Negroes of both sexes, ranging in age from 19 to 91 years, obtained from the Terry Anatomical Collection in St. Louis. Trotter and Gleser found that there was a statistically significant decline of stature with age and that the rate of decline was homogenous across both races and both sexes. They also found that Rollet's data showed the same relationship of stature to age as the American sample. They concluded that the average rate of decline in stature which they found should be applicable to the general population. The rate of decline was 1.2cm per 20 years. They were not able to determine the age of onset of this decline. In their study, they "arbitrarily" selected 30 years as the age of onset of this regression in height.

The second study by Trotter and Gleser, using the same 855 skeletons as in the previous study plus the skeletal remain of 611 American White and Negro male military personnel, was to provide data bearing on the effect of the secular factor on maximum stature of individuals born in successive decades. Although they found minor fluctuations in the nineteenth century and a rapid increase in the twentieth century, their study, covering 85 consecutive years, refuted the hypothesis that stature has increased progressively from decade to decade.

The third article to appear in 1951 was again concerned with the estimation of stature from the long bones. This study, by Dupertuis and Hadden,

was based on measurements from 400 American skeletons from the Todd Osteological Collection in Cleveland, Ohio. These skeletons were equally divided among White males, White females, Negro males, and Negro females. The ages ranged from 20 to 65 years for the two White series and from 20 to 45 years for the two Negro series. The results of this study paralleled those of Pearson. As was expected, Dupertuis and Hadden found that each of the formulae gave the best results when applied to the population from which it originated. They also developed general formulae for use in cases where race was unknown.

This study by Dupertuis and Hadden did not receive the expected amount of attention because of a third study by Trotter and Gleser which appeared in 1952. The material for this study came from two sources: skeletons of military personnel drawn from American World War II casualties in the Pacific Zone and skeletons from the Terry Anatomical Collection. Trotter and Gleser were able to utilize skeletons of 1,200 male military personnel (1,115 Whites, 85 Negroes) and of 850 subjects from the Terry Collection (255 White males, 63 White females, 360 Negro males, and 177 Negro females). The results showed that, after correction for aging, the formulae for the estimation of stature based on the Terry Collection and on the military personnel were in substantial agreement. The study also indicated a need to deduct 2.5cm from cadaver stature to obtain the equivalent of living stature. A comparison of their results with those of other investigators showed the newly developed formulae to be the best for use on American Whites and Negroes.

In 1958, Trotter and Gleser completed yet another study on the estimation of stature from the long bones. This study, based on the remains of American military personnel from the Korean War, updated and expanded their 1952 study. The new sample consisted of 4,672 Whites, 577 Negroes, 92 Mongoloids, 112 Mexicans, and 64 Puerto Ricans. By comparing the findings of the

1958 study to those of the 1952 study, Trotter and Gleser concluded that equations for estimation of stature should be derived anew when opportunities present themselves. This conclusion sprang mostly from the indication that the personnel from the Korean War showed a continuation of growth, possibly to their 23rd birthday, as opposed to the World War II dead, which showed no significant increase in stature after 18 years of age.

The Trotter and Gleser studies of 1952 and 1958 are presently the most commonly used reference for estimation of stature for the purpose of identification of skeletal remains in forensic cases in the United States.

In 1956, a study by Fully again introduced basically the same method mentioned by Dwight in 1894, using measurements which amounted essentially to laying the skeleton out and measuring it from head to foot. Fully, however, eliminated the need for reconstructing the curve and spacing of the vertebral column by measuring each vertebrae individually and using the total of these measurements in his computations.

In 1960, Fully and Pineau reiterated the method introduced in 1956 and added a study using the vertebral column which was, according to Pearson, long overdue. As noted previously, Pearson had commented in 1927 that the correlation between the individual vertebrae and the length of the vertebral column was unknown and that research should be done in this area. He also suggested that study be conducted to determine the correlation between the vertebrae and stature. Fully and Pineau partially addressed these subjects in their research.

Using 164 male skeletons between the ages of 18 and 65 years and between the heights of 151 and 188 centimeters, Fully and Pineau developed regression formulae for the estimation of the length of the column from certain groups of vertebrae and for the estimation of stature from the lumbar vertebrae plus the length of either the femur or the tibia. The skeletons used in this study

were obtained from World War II concentration camps and consisted of 45% French subjects, 27% Italians, and 28% other European nationalities.

Fully and Pineau measured each vertebra in its dry state, using the maximum height of the vertebral body. Since there was no indication that they restricted their measurements to the midline, it is assumed that they did not make such a restriction. They used these measurements and their sums to develop regression formulae for estimation of the length of the vertebral column from the following groups of vertebrae: 1) the first three thoracic; 2) the 5th, 6th, and 7th thoracic; 3) the last three thoracic; 4) the 5th, 6th, and 7th thoracic and the first three lumbar; and 5) the last three thoracic and the first three lumbar. In addition, they presented a table which gives the percentage of each of the vertebrae to the total of the vertebral column.

Fully and Pineau also developed two regression formulae for the estimation of stature. One utilized the sum of the femur and the five lumbar vertebrae. The other utilized the tibia and the five lumbar vertebrae. The coefficients of correlation for these two formulae were 0.926 and 0.908, respectively. The standard errors were 2.35cm and 2.54cm, respectively. This exceeds the accuracy of all previous methods for estimating stature using the long bones alone. Fully and Pineau did not, however, develop regression formulae for estimation of stature from the vertebral column alone nor did they explore any other section of the column for use with the long bones. This would seem a logical extension of their study. Indeed, the estimation of stature from the vertebral column without the use of the long bones seems to be a serious ommission from their study in light of their regression formulae for the estimation of the lenth of the column.

Although several studies have not been mentioned, this historical overview provides the reader with the major studies dealing with the estimation

of stature in forensic cases in the United States, along with those studies which have a direct impact on this research. The vast majority of the research in this field has dealt with the long bones and very little has been done with the vertebral column.

III. METHODS AND MATERIAL

The subject matter utilized in this study consisted of 100 Negro male and 100 Negro female skeletons obtained from the Terry Anatomical Collection located at the National Museum of Natural History, Smithsonian Institution, Washington, D.C. The Terry Collection consists of the skeletons of approximately 1,600 cadavers which were dissecting room material at Washington University, St. Louis, Missouri during the 51 years between 1914 and 1965 (Stewart, 1969). These cadavers were subjected to a series of anthropometric measurements prior to dissection and records are available giving, among other information, the age, race, sex, and, in most cases, stature.

The technique utilized to measure the stature of the cadavers was explained by Terry in 1940. A special measuring panel (Plates 9, 10, 11, 12) was constructed which allowed characteristic features of standing posture to be reproduced. The cadavers were carefully posed with "ankles bent, knees and hips extended, lumbar curve produced, shoulders squared and arms hanging at the sides, the face front and eye-ear plane horizontal". This was done in order to reproduce the living stature of the individual as opposed to the cadaver stature normally obtained in the supine position. In spite of these attempts, Trotter and Gleser (1952) indicate that an average of 2.5cm must be subtracted from the recorded statures for the Terry Collection in order to obtain living stature.

Trotter and Gleser (1951a) also pointed out that when using the Terry Collection for the estimation of stature, it is necessary to visually verify the recorded stature. Corrections were necessary since some of the subjects' feet were not placed flat on the baseboard of the measuring panel and it was

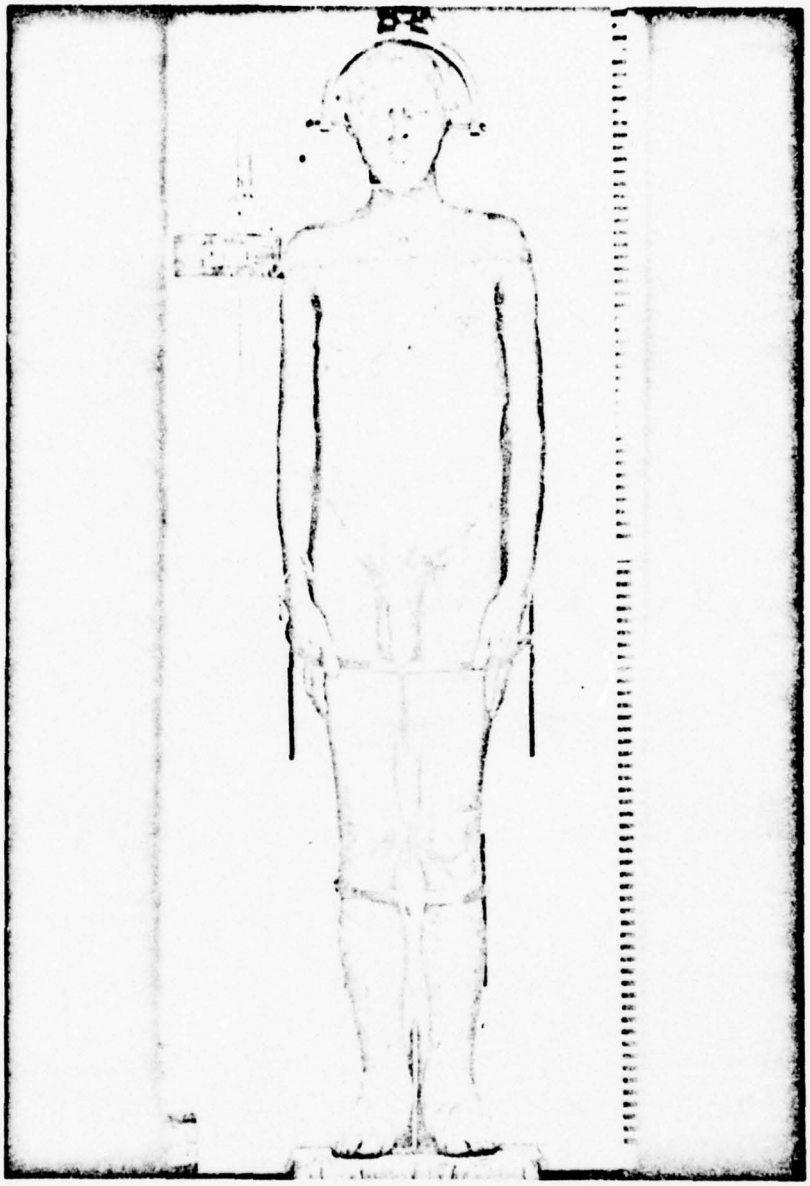

Plate 9 Cadaver measuring panel, front view

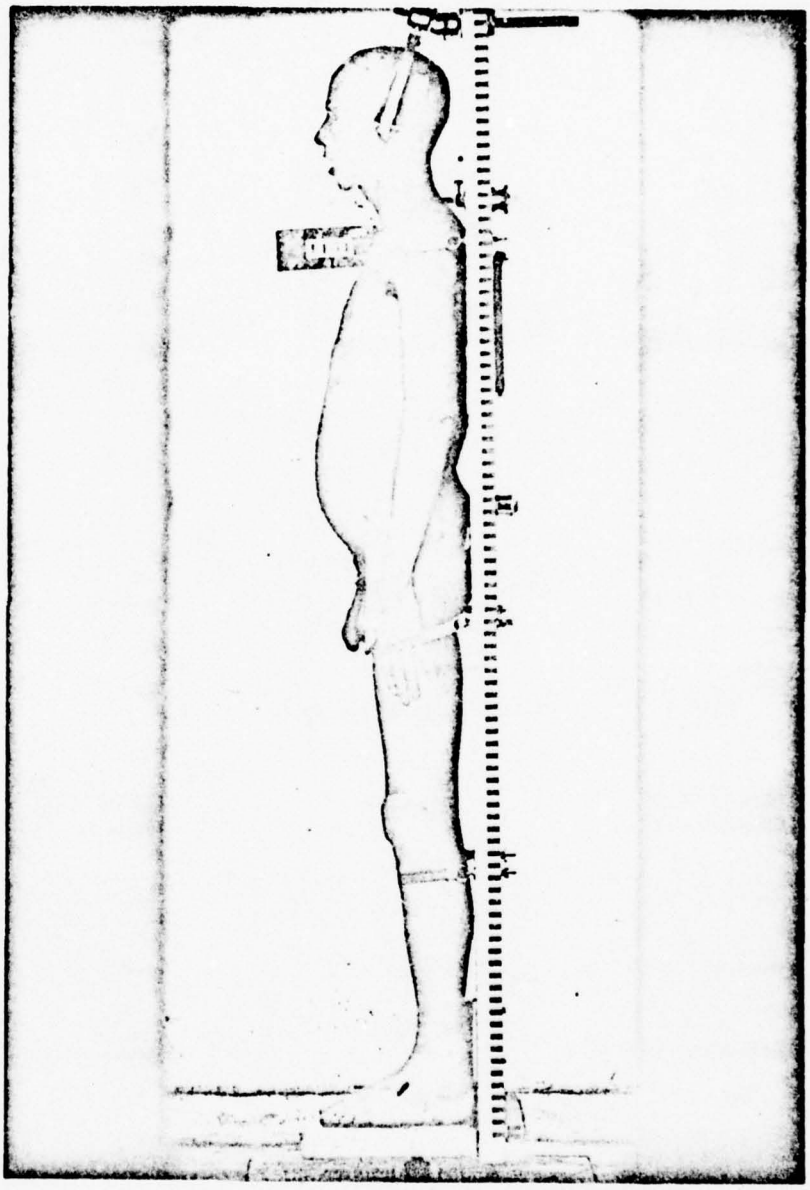

Plate 10 Cadaver measuring panel, side view

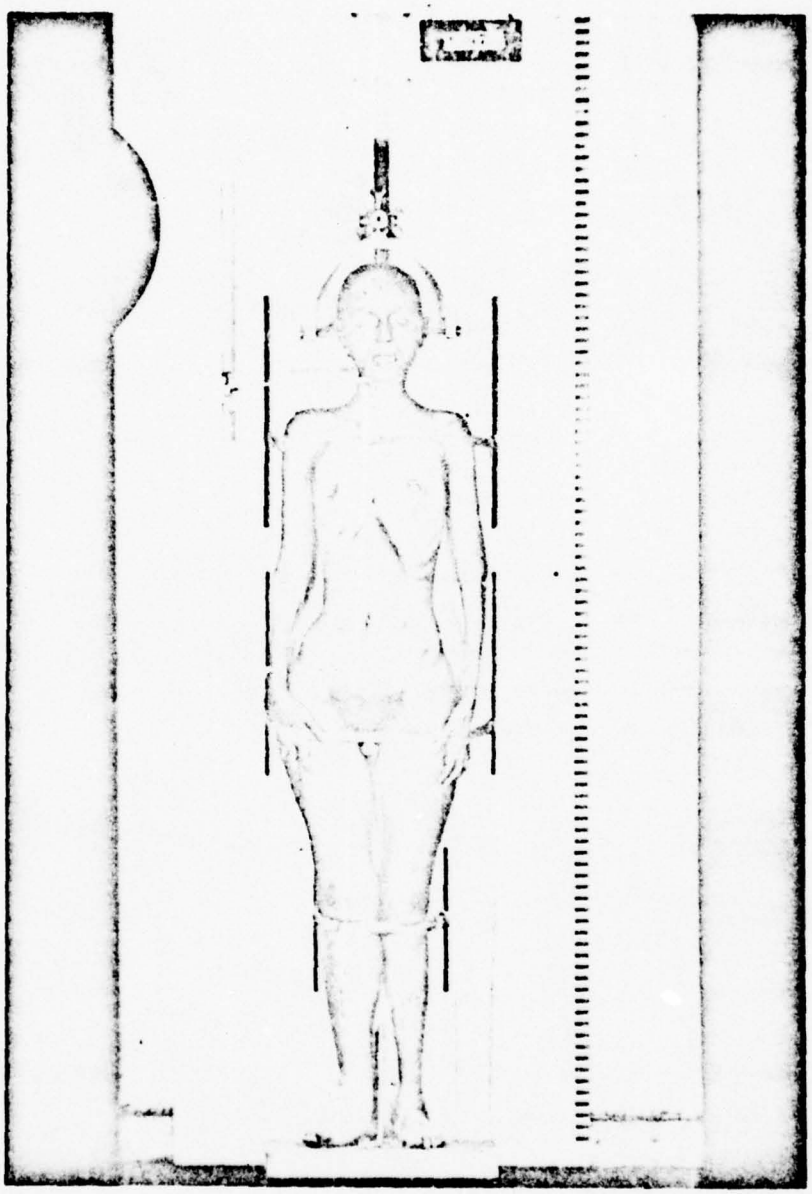

Plate 11 Cadaver measuring panel, front view

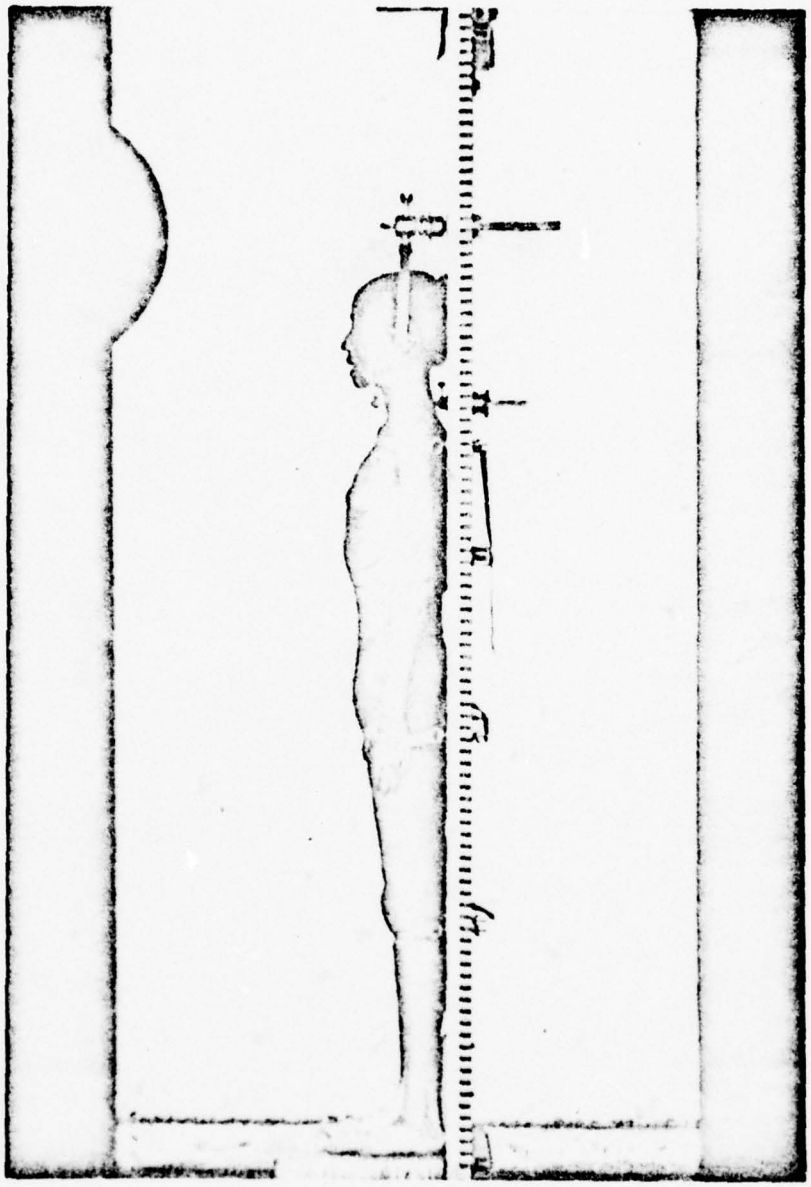

Plate 12 Cadaver measuring panel, side view

possible to make corrections since a measuring rod was included in the photographs contained in the information folder for each cadaver.

In view of Trotter and Gleser's (1951a) findings on the effects of aging on stature, an attempt was made to use only subjects between the ages of 23 and 40 years, inclusive. Unfortunately, after eliminating those skeletons whose stature had not been recorded, those whose statures were uncorrectable, and those whose vertebrae were unsuitable for study, it was necessary to extend the age limits on the females in order to obtain 100 usable skeletons. For this reason, the males range in age from 23 to 40 years while the females range from 19 to 50 years, inclusive (see Figures 1 & 2). The average age of the males is 32.82 years, the average for the females is 34.34 years.

In order to compensate for the reduction in stature due to age, the stature of all those cadavers over thirty years of age have been corrected by adding 0.6mm to the recorded stature for each year of age over thirty.*

The heights of the vertebrae were determined by measuring the maximum midline height of the vertebral bodies using sliding calipers. Each vertebrae was measured individually and bone-group lengths were subsequently determined by adding the individual heights of the appropriate vertebrae.

Table 1 lists the data obtained from the male subjects; table 2 lists the data obtained from the female subjects. The statures in these tables have not been corrected for any reduction due to age.

The first cervical vertebrae was not utilized in this study since it has no body. Bone-groups 1 through 23 consist of the single vertebrae C2 (second cervical) through L5 (fifth lumbar). The remaining bone-groups consist of the first 23 taken two at a time (C2, C3; C3, C4; C4, C5; etc.),

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*Since the stature was originally recorded only to the nearest millimeter, the stature was increased by .6mm per year truncated to the millimeter.

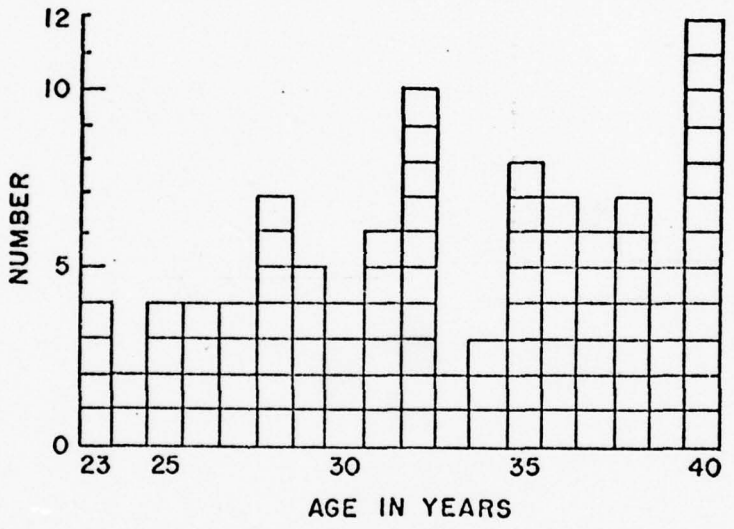

FIG. 1 AGE DISTRIBUTION OF 100 NEGRO MALES

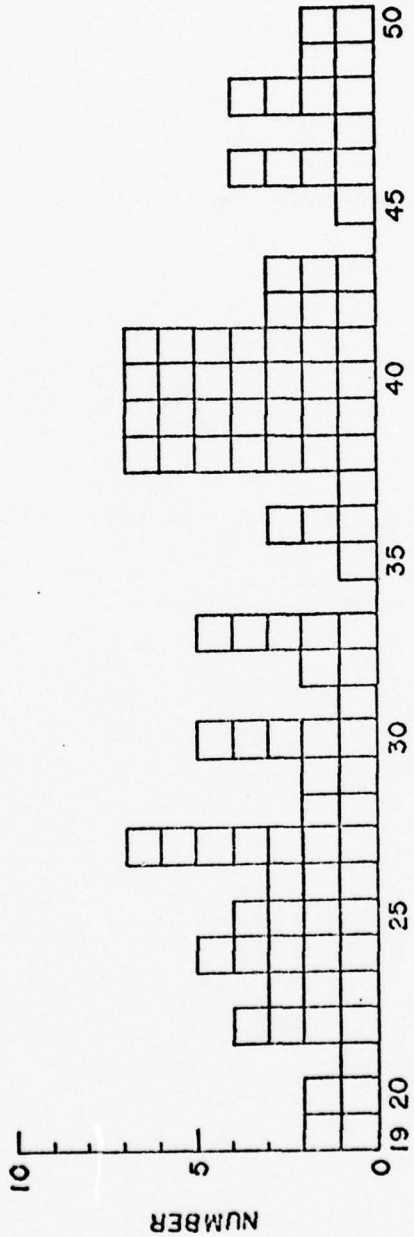

FIG. 2 AGE DISTRIBUTION OF 100 NEGRO FEMALES

Table 1

MEASUREMENTS TAKEN ON 100 NEGRO MALE SKELETONS
(IN MILLIMETERS)

ID#	AGE	HT	C2	C3	C4	C5	C6	C7	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	L1	L2	L3	L4	L5
31R	38	1749	38.0	13.5	13.0	12.0	13.0	15.0	17.0	17.0	17.0	16.0	17.0	19.5	20.0	20.0	21.0	21.5	22.5	24.5	25.0	25.5	26.5	26.5	25.5
145R	31	1940	44.0	17.5	16.5	16.0	16.0	18.0	20.5	21.0	21.0	21.0	22.0	24.0	23.5	23.5	24.0	25.5	27.0	29.0	31.5	30.0	32.0	32.0	34.0
153R	34	1698	39.0	13.0	13.5	13.0	13.0	15.0	17.0	17.5	17.5	18.0	18.0	18.5	18.5	20.0	20.5	21.0	23.0	25.0	28.0	28.5	27.0	27.0	30.0
251	33	1840	42.0	15.0	14.5	13.0	13.0	15.0	18.0	19.0	19.5	19.0	21.0	22.5	22.0	22.5	21.5	23.5	26.5	29.0	30.0	30.0	30.0	30.5	29.5
269	30	1720	37.5	14.0	13.0	14.0	14.0	15.0	17.0	18.0	19.0	19.0	19.0	20.0	21.5	21.5	21.5	22.5	25.0	25.0	26.0	28.0	28.5	26.0	26.5
302R	29	1768	36.0	14.5	14.0	13.0	13.5	15.0	17.5	18.5	18.5	19.0	19.0	20.0	21.0	21.0	22.0	23.0	25.0	26.0	27.5	28.0	28.5	29.0	29.5
308	35	1808	45.0	14.0	13.5	13.0	13.0	14.5	17.0	19.0	20.0	19.0	19.0	20.0	20.0	20.0	21.5	22.5	24.0	25.5	28.0	29.5	28.0	30.0	30.5
565	32	1770	39.0	16.0	14.0	14.0	15.0	16.0	17.0	17.5	20.0	21.0	19.0	21.5	22.0	23.0	23.0	24.0	26.0	27.0	28.5	28.0	29.0	28.0	28.0
570	37	1750	38.0	12.0	12.5	12.0	11.5	13.0	17.0	18.5	19.0	19.0	19.0	19.0	21.0	20.0	21.0	21.5	24.0	26.0	28.0	28.0	27.5	26.5	26.0
578	32	1710	42.0	14.0	14.0	14.0	13.0	15.0	18.0	19.5	19.5	20.0	21.0	22.0	22.0	22.5	23.0	24.5	25.0	27.0	28.5	30.0	30.5	31.0	30.5
581	30	1840	39.0	14.0	13.0	13.5	15.0	16.0	18.0	19.0	19.0	21.0	22.5	22.0	22.0	22.5	22.0	22.5	24.5	26.0	28.5	30.0	30.0	29.5	29.0
592	25	1735	38.5	14.5	15.0	15.0	14.0	15.0	17.5	18.5	19.0	19.5	20.0	21.0	21.5	21.0	22.5	23.0	25.0	26.0	27.5	28.0	28.5	29.0	32.0
595	25	1840	40.5	14.0	13.0	13.0	13.5	14.5	18.0	19.0	20.0	20.0	20.0	20.0	20.5	21.0	20.5	23.0	24.5	26.0	28.0	27.0	27.0	26.5	27.0
606	28	1630	38.0	15.0	14.0	13.5	12.5	14.0	16.0	17.0	18.5	18.0	18.5	19.0	20.0	20.0	20.5	21.0	23.5	25.0	27.0	28.0	27.0	26.0	26.5
673	38	1850	41.5	14.5	13.5	13.5	14.0	16.0	18.0	19.5	20.0	20.0	21.0	21.0	21.0	21.0	21.0	22.5	24.0	25.0	27.0	27.0	26.5	28.0	27.0
675	27	1760	39.0	13.5	14.0	14.0	13.5	15.0	17.5	17.5	18.0	19.0	18.0	18.5	20.0	21.0	21.0	25.0	22.5	26.0	27.0	27.0	27.0	27.0	27.0
684	35	1740	38.0	13.0	14.0	12.0	12.5	13.0	16.0	19.0	18.0	18.5	13.5	20.5	20.5	21.0	22.5	23.5	25.5	27.0	28.0	27.5	28.0	29.0	30.0
698	40	1780	36.5	10.5	12.0	11.5	10.0	10.5	14.0	17.0	19.5	20.0	21.0	21.5	23.0	23.0	23.0	24.0	26.0	27.0	28.0	28.5	28.5	27.0	26.0
704	40	1659	37.0	13.0	13.0	12.5	13.0	14.0	16.0	18.0	19.0	19.0	20.0	21.0	21.0	21.0	22.0	24.0	24.0	25.0	27.5	28.0	29.5	28.0	30.5
707	26	1870	40.0	15.0	14.0	14.5	13.5	14.5	18.0	19.0	19.0	19.0	19.5	20.0	21.5	23.5	23.0	23.5	26.0	29.0	31.0	30.0	31.0	31.5	32.0
717	29	1699	38.0	15.0	13.0	12.0	12.5	14.0	16.0	17.0	18.5	19.5	19.5	20.5	21.5	22.0	22.0	22.5	23.5	25.0	27.0	27.5	28.0	29.0	31.0

Table 1

MEASUREMENTS (CONTINUED)

ID#	AGE	HT	C2	C3	C4	C5	C6	C7	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	L1	L2	L3	L4	L5
719	25	1780	37.0	14.0	14.0	13.5	14.0	15.0	16.0	18.0	17.5	18.0	20.0	18.0	19.0	19.5	20.0	21.0	23.5	25.5	28.0	28.5	28.5	28.0	27.5
737	38	1780	39.0	15.0	14.0	13.5	14.5	16.0	18.0	19.0	19.5	19.5	19.5	20.0	21.0	21.0	22.0	22.0	25.0	27.5	28.0	29.0	30.0	30.0	30.0
767	28	1730	35.5	10.5	10.0	10.0	11.0	12.0	14.0	15.0	15.5	17.0	18.0	18.0	17.0	18.0	19.5	20.0	24.0	25.0	27.0	27.0	26.0	27.5	28.5
776	40	1650	37.5	12.5	12.0	12.0	12.0	15.0	17.0	19.0	19.0	19.0	18.0	19.5	20.0	20.0	20.0	23.0	24.0	26.0	27.0	27.0	28.0	27.0	29.0
779	39	1890	39.0	14.0	14.0	15.0	14.0	15.0	13.0	20.0	20.0	20.0	21.0	22.0	23.0	22.5	23.0	24.5	26.0	28.0	29.0	29.5	29.0	30.0	31.0
780	30	1750	33.5	15.0	14.0	13.5	14.0	15.0	18.0	18.0	18.5	19.0	20.0	19.5	20.5	21.0	22.0	25.0	27.0	28.0	29.0	29.0	29.0	30.0	30.0
782	30	1650	30.0	15.0	14.0	12.5	12.0	14.0	17.0	18.5	18.5	18.5	19.5	20.0	21.0	21.0	20.5	22.5	25.0	27.0	27.0	27.0	27.0	27.0	29.0
789	40	1600	36.0	14.0	14.0	13.5	15.0	15.0	17.5	20.0	19.0	20.0	21.0	21.0	21.5	21.0	21.0	22.0	25.0	27.5	29.5	28.0	28.5	26.5	28.0
792R	31	1730	35.0	14.0	14.0	13.0	14.0	14.5	18.0	19.0	19.0	18.5	19.5	20.0	20.0	20.0	20.5	22.0	23.5	26.5	28.0	28.5	29.0	28.0	29.0
821	27	1740	38.0	14.5	14.0	13.5	14.0	15.0	17.0	18.5	19.0	19.0	19.0	19.0	20.0	20.5	21.0	22.5	23.0	24.5	26.0	26.0	26.0	24.5	25.5
826	38	1630	41.0	17.0	15.5	14.5	14.0	15.0	17.5	18.0	18.0	19.0	20.0	21.0	22.0	22.0	23.0	25.0	27.0	29.5	30.0	29.0	29.0	30.0	32.0
830	28	1810	38.0	14.0	14.0	13.5	13.5	15.0	18.0	19.0	20.0	20.0	19.5	20.0	20.5	20.5	20.0	22.5	24.5	26.5	28.0	28.0	27.0	26.0	24.0
836	35	1750	36.0	13.0	12.0	11.0	11.0	14.0	17.0	19.5	19.5	19.5	19.0	20.0	20.0	22.0	21.0	22.0	23.0	26.0	27.0	27.0	27.0	27.0	27.0
850	23	1790	35.0	11.5	13.0	12.0	12.0	14.0	17.0	18.0	17.5	17.0	19.0	20.0	20.0	21.0	22.0	22.0	24.5	26.5	28.5	29.0	30.0	30.0	29.0
862	37	1715	30.0	13.0	12.0	12.0	12.0	13.5	15.5	17.0	17.0	17.0	17.5	18.0	19.0	19.5	20.0	20.0	21.0	22.0	23.5	24.5	25.5	25.0	26.0
881	24	1725	38.0	13.5	14.0	14.0	13.0	15.0	19.0	20.0	20.0	19.0	20.0	18.0	20.5	20.0	22.0	22.0	23.0	25.5	28.0	29.0	29.0	31.0	30.5
882	35	1820	43.5	16.0	15.0	16.0	16.0	17.0	20.0	21.0	21.0	21.0	22.0	23.0	23.5	23.5	24.0	27.0	28.0	29.0	30.0	31.0	31.0	32.0	32.0
883R	40	1710	37.0	14.0	14.0	13.5	13.5	14.0	16.0	18.0	19.5	20.0	20.5	21.0	22.0	21.5	21.5	21.5	23.0	25.0	26.5	26.5	26.5	27.5	28.0
885	26	1805	43.0	17.0	16.5	15.0	15.5	16.0	18.0	20.0	20.0	21.0	21.0	22.0	22.0	23.0	24.0	24.0	26.0	27.0	29.0	30.5	32.5	33.0	34.0
902	36	1820	41.5	13.5	13.0	13.0	13.0	14.5	15.0	16.5	18.0	19.0	19.0	19.5	20.5	21.0	22.0	23.0	24.0	26.0	28.0	28.0	26.5	25.0	26.5
905	31	1870	40.0	14.0	14.0	13.5	14.5	16.0	19.5	21.0	21.5	22.5	23.0	23.0	22.0	22.0	22.5	25.0	27.0	29.0	30.0	30.0	29.0	28.0	31.0

Table 1

MEASUPEMENTS (CONTINUED)

ID#	AGE	HT	C2	C3	C4	C5	C6	C7	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	L1	L2	L3	L4	L5
915	27	1805	40.0	14.5	14.5	13.5	14.0	15.5	18.0	19.0	20.0	19.0	20.0	20.0	21.0	21.0	21.0	22.5	24.0	26.0	28.0	28.0	29.0	28.0	27.0
922	38	1715	38.0	13.0	12.5	13.0	13.0	14.0	16.5	20.0	20.0	19.5	20.0	20.0	20.0	21.0	21.0	23.0	24.0	25.0	25.5	27.0	27.0	26.0	26.0
943	40	1715	34.5	13.0	13.0	13.0	13.0	15.0	17.0	17.0	18.0	17.5	18.5	19.5	20.0	21.0	22.0	23.0	24.0	25.5	26.0	25.0	26.0	26.0	27.0
955	26	1640	38.0	14.0	13.0	13.0	14.0	14.5	18.0	19.0	19.0	18.0	18.0	19.0	20.0	20.5	20.0	21.0	22.0	24.5	26.5	26.0	25.0	26.0	26.0
990	28	1670	40.0	15.0	13.0	13.0	13.0	15.0	17.0	19.0	18.5	18.0	19.0	19.0	20.5	21.0	21.0	21.0	22.0	25.0	26.5	26.5	25.0	24.5	25.5
1001	32	1775	39.5	14.0	13.0	13.0	13.0	14.0	17.0	20.0	20.0	20.0	20.5	21.0	20.5	20.5	21.0	24.0	25.5	26.5	28.0	27.5	27.5	26.0	28.0
1007R	39	1791	38.0	13.5	14.0	14.0	14.0	14.5	17.5	19.5	19.0	19.5	20.0	21.0	21.0	21.0	23.0	24.5	25.0	26.0	27.5	28.0	27.5	28.0	29.5
1013	30	1750	38.0	14.0	13.5	13.5	14.0	15.0	16.0	17.0	19.0	19.0	20.0	21.0	21.5	22.0	22.5	23.5	25.0	27.0	27.5	26.0	26.5	27.0	30.0
1014	40	1832	40.5	16.0	15.5	15.0	15.0	17.0	18.0	18.0	20.0	20.5	20.5	21.0	21.0	22.0	22.5	24.0	26.0	27.5	30.0	29.0	30.0	28.5	28.5
1020	24	1790	39.0	14.5	14.5	12.5	13.0	13.5	17.0	18.0	19.0	18.0	18.0	19.0	19.5	20.0	21.0	22.5	24.0	26.0	27.0	26.0	29.0	28.0	29.0
1022	32	1660	36.0	14.0	13.5	13.5	14.5	15.5	17.0	18.5	19.0	19.0	20.0	20.5	20.5	21.0	22.0	24.0	25.0	27.0	28.0	27.5	27.5	28.0	29.0
1031	27	1825	40.0	15.0	15.0	14.5	14.0	15.0	16.5	18.0	19.0	19.0	20.0	20.0	20.0	20.5	21.0	22.0	24.0	28.0	28.5	30.0	30.5	29.0	28.0
1033	23	1730	37.0	14.0	14.0	14.0	14.0	16.0	18.0	19.0	19.0	19.0	18.5	20.0	20.5	21.0	22.0	23.0	24.0	26.0	27.5	27.5	30.0	28.0	28.5
1036	38	1700	33.5	12.0	11.5	11.0	12.0	12.5	14.5	15.5	17.0	18.0	18.5	19.0	19.0	20.0	22.0	23.0	24.0	26.0	26.0	26.0	27.0	28.0	28.0
1040	33	1680	32.0	10.5	11.0	11.0	10.5	11.0	14.5	17.0	18.5	18.5	18.0	19.0	19.0	20.0	20.0	20.0	21.0	22.5	25.5	26.0	26.0	25.5	25.5
1068	23	1660	37.0	12.5	13.0	12.0	12.0	14.5	17.0	17.5	18.0	19.0	19.5	19.0	19.5	18.0	20.5	21.5	24.0	24.5	26.0	26.5	26.5	28.0	29.0
1081	40	1705	43.0	13.5	13.5	14.0	14.0	15.0	18.0	20.0	20.5	20.0	21.0	22.5	24.0	23.5	23.0	25.0	27.0	28.0	30.0	29.0	29.5	29.0	30.0
1093	29	1900	40.0	14.0	13.5	13.0	12.0	14.0	18.0	19.0	19.0	18.5	19.0	20.0	20.0	22.0	22.5	25.0	25.0	28.5	30.0	30.0	30.0	28.0	28.0
1106	29	1740	37.5	13.0	13.0	13.0	13.0	14.5	17.0	19.0	20.0	19.0	19.5	20.0	20.0	21.0	21.0	22.0	23.0	25.0	27.0	27.0	27.5	27.5	25.0
1113	29	1825	38.0	16.5	14.0	14.0	14.0	16.0	17.0	19.0	19.0	19.5	21.0	21.5	22.0	22.5	21.5	22.5	25.5	27.5	29.0	28.0	28.0	28.0	28.0
1171	31	1800	37.5	13.0	13.0	12.5	12.5	13.5	15.0	16.0	17.0	17.0	18.0	18.0	18.0	19.0	19.5	21.0	24.0	25.0	26.0	26.0	27.0	27.0	28.0

Table 1

MEASUREMENTS (CONTINUED)

ID#	AGE	HT	C2	C3	C4	C5	C6	C7	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	L1	L2	L3	L4	L5
1138R	37	1746	40.5	15.0	14.5	15.0	14.0	16.0	18.0	19.5	20.0	21.0	22.0	21.5	21.5	22.0	22.0	22.5	24.5	26.0	28.5	28.5	28.5	28.0	27.5
1146R	35	1823	37.5	10.5	11.0	11.0	11.0	13.0	16.0	18.0	18.0	18.0	19.0	19.0	20.0	20.5	21.0	22.0	23.0	25.0	26.0	27.0	28.5	29.5	28.5
1147R	32	1710	36.0	14.0	13.5	12.5	13.0	14.5	16.5	17.0	18.0	18.0	18.5	19.0	19.5	20.0	20.0	21.5	23.0	25.5	27.0	26.5	27.0	26.0	26.0
1148	23	1810	39.5	14.5	14.0	13.5	13.5	14.5	17.0	18.0	18.0	17.5	18.0	20.5	20.0	20.0	20.0	22.5	24.5	25.0	27.0	28.5	28.5	29.5	29.5
1151	32	1814	42.0	14.5	14.0	14.0	14.5	15.0	18.0	18.5	18.5	19.0	19.0	19.0	20.5	21.0	22.0	22.0	25.0	27.0	28.0	29.0	29.5	30.5	30.0
1152	32	1775	35.0	13.5	14.0	12.0	13.5	15.0	18.0	20.0	19.5	18.0	19.0	19.0	20.0	20.5	22.0	23.0	25.0	27.5	28.5	28.0	29.0	29.0	28.5
1157	40	1675	35.5	12.0	12.0	12.5	13.5	14.0	16.5	17.5	18.0	18.0	19.0	20.0	20.0	21.0	22.5	24.0	25.0	26.0	27.0	28.0	29.0	27.0	26.5
1159	26	1813	38.0	14.5	14.0	13.5	13.5	15.0	18.0	19.0	20.0	20.0	20.0	20.0	21.5	23.0	23.0	23.0	24.5	26.0	28.0	29.0	31.0	30.5	29.5
1168	33	1690	33.0	12.5	13.0	12.0	12.0	13.5	16.5	18.0	19.0	19.0	20.0	21.0	22.0	22.5	23.0	24.0	24.5	26.0	26.5	26.5	27.5	27.0	26.5
1169	28	1740	35.0	14.0	13.0	13.0	13.5	14.0	16.5	18.0	18.5	19.0	19.0	20.0	20.0	20.5	21.0	22.5	24.0	25.5	26.5	27.0	27.0	27.0	27.0
1185	32	1630	35.5	13.5	13.0	11.5	12.5	13.5	16.5	18.0	17.0	17.5	18.0	19.0	19.0	20.0	20.0	22.0	23.0	24.0	26.0	27.0	26.0	26.0	27.0
1205	39	1720	39.5	13.5	13.0	13.0	13.0	14.5	17.0	19.0	19.5	19.0	21.0	21.5	22.0	21.5	21.5	23.5	26.5	28.0	28.0	29.0	28.0	28.0	28.5
1206	25	1655	33.0	12.5	12.0	12.0	11.5	13.0	15.0	16.5	16.0	17.0	17.5	17.5	18.0	19.0	20.5	21.5	23.0	24.0	24.5	25.0	24.5	25.0	25.0
1251	36	1810	37.0	13.0	13.0	13.0	12.5	14.0	16.5	18.0	18.0	18.5	19.5	20.0	20.0	20.5	22.0	24.0	26.0	27.0	28.5	28.5	29.0	29.0	28.5
1254	37	1580	31.5	13.0	13.5	12.0	12.0	13.0	15.0	16.5	17.0	17.0	18.5	19.0	20.0	20.0	20.0	20.5	22.5	25.0	27.0	25.0	25.0	24.5	25.5
1257	40	1720	38.0	13.0	12.5	13.0	12.0	14.0	18.0	17.5	18.0	18.0	18.0	19.0	20.5	20.0	20.5	21.0	23.0	25.0	26.5	28.0	27.0	27.0	28.0
1268	32	1750	41.5	16.5	16.0	16.0	15.0	16.0	17.5	18.5	19.0	19.0	19.5	20.5	21.0	21.5	22.0	23.0	24.0	26.0	28.0	28.5	29.0	28.0	28.0
1285	36	1620	36.0	13.5	13.0	12.0	11.5	13.0	15.5	17.5	19.0	19.5	20.0	20.0	20.5	21.0	20.0	21.5	23.0	24.0	25.5	27.0	27.0	26.0	24.5
1300	28	1670	39.0	14.0	14.0	13.5	13.0	14.0	16.0	18.0	17.0	18.5	19.0	19.0	20.0	20.5	21.0	22.0	24.0	25.0	27.0	27.0	26.5	26.0	27.0
1312	40	1620	33.0	13.0	12.5	11.5	11.5	12.0	14.0	15.0	16.5	16.0	16.0	15.5	16.5	17.0	18.0	19.0	20.5	22.0	24.0	25.0	25.5	24.5	24.5
1319	36	1730	36.5	15.0	12.5	12.0	12.0	14.5	16.0	17.5	18.5	19.5	20.0	20.5	21.0	21.5	22.0	23.0	24.5	25.5	26.0	26.5	26.0	26.5	27.5

Table 1

MEASUREMENTS (CONTINUED)

ID#	AGE	HT	C2	C3	C4	C5	C6	C7	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	L1	L2	L3	L4	L5
1322	34	1690	40.0	14.0	13.0	13.0	12.5	15.0	17.0	18.0	18.0	18.5	19.0	19.0	19.0	19.5	20.5	22.0	24.0	25.0	26.0	26.0	27.0	26.0	28.5
1331	31	1740	33.5	14.5	15.0	13.5	14.0	14.5	17.0	19.0	18.5	19.0	20.0	21.0	21.0	21.0	22.0	24.0	26.5	27.0	27.0	27.0	27.5	27.5	27.0
1362	36	1890	36.0	14.5	13.0	11.5	11.0	13.0	16.5	18.0	19.5	19.0	19.5	20.0	21.5	22.5	23.0	24.0	26.5	28.0	29.0	29.0	28.0	27.5	27.0
1367	32	1695	35.0	15.0	14.0	14.5	15.0	16.0	17.0	18.0	19.0	19.5	20.0	23.0	22.5	24.0	24.0	25.5	26.0	27.0	26.5	28.0	29.0	30.0	31.5
1368	37	1690	36.0	13.0	12.0	11.5	12.5	14.0	16.5	18.0	18.0	19.0	19.0	20.0	20.0	20.5	21.0	21.5	24.0	26.0	26.5	25.5	26.5	27.0	26.0
1373	40	1758	40.0	14.0	14.0	13.0	13.0	14.0	17.0	19.0	20.0	21.0	21.5	22.0	22.0	22.0	22.0	24.0	25.5	27.0	28.0	28.0	28.0	29.0	30.5
1375R	38	1756	38.0	13.5	12.5	12.5	13.0	15.0	16.0	16.5	18.0	18.5	19.0	19.0	20.0	20.0	21.0	23.0	26.5	28.0	27.0	28.0	29.0	30.5	29.0
1388	29	1770	40.0	14.5	12.0	13.0	13.5	15.0	17.5	19.0	19.5	19.0	20.0	21.0	21.0	22.0	22.5	22.5	23.5	25.0	28.0	30.0	30.0	30.0	29.0
1397	35	1755	38.0	14.0	13.0	13.0	13.5	14.5	17.0	19.0	19.0	19.5	20.0	20.5	22.0	22.5	23.5	24.0	26.0	28.0	28.5	28.5	29.0	30.0	29.0
1398	31	1700	41.0	14.0	13.0	13.0	13.5	15.5	17.5	19.0	19.0	19.0	20.0	20.0	20.0	21.0	21.5	22.0	24.0	26.0	27.0	28.0	28.5	28.0	29.5
1399	37	1710	37.0	14.0	13.0	12.5	12.5	13.5	16.0	17.0	17.0	17.0	18.5	19.0	19.0	20.0	21.0	22.0	23.0	24.5	25.0	25.0	26.0	26.0	28.5
1415R	34	1798	40.0	14.5	12.5	12.5	14.0	15.5	18.0	20.0	20.5	20.5	21.0	21.5	20.5	20.0	21.0	23.5	24.5	26.0	28.5	29.0	29.5	30.0	28.5
1422R	35	1772	37.0	14.0	14.0	13.0	13.5	14.5	16.0	18.0	18.5	19.0	19.5	21.0	21.0	21.5	23.0	23.5	25.5	26.5	28.0	29.0	29.0	29.0	29.0
1451	36	1615	35.0	13.0	13.5	13.5	13.0	15.0	17.0	17.5	18.0	17.5	18.0	19.0	20.0	20.5	21.0	21.0	22.0	24.0	25.0	24.0	26.0	26.0	26.5
1470	35	1672	35.5	15.0	12.0	12.5	13.0	15.0	18.5	18.5	19.0	19.5	20.5	22.0	22.0	22.5	23.0	23.0	24.0	25.0	26.0	27.0	25.0	25.0	28.5
1489	39	1650	37.0	14.0	14.0	13.5	13.0	14.0	17.5	19.0	18.0	19.0	19.0	20.0	21.5	22.0	23.0	24.0	25.0	26.0	27.0	27.5	28.0	27.0	27.0

Table 2

MEASUREMENTS TAKEN ON 100 NEGRO FEMALE SKELETONS
(IN MILLIMETERS)

ID*	AGE	HT	C2	C3	C4	C5	C6	C7	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	L1	L2	L3	L4	L5
32R	43	1503	34.0	12.5	12.0	12.0	13.0	13.0	15.0	16.0	17.0	17.0	18.0	18.5	19.0	20.0	21.0	21.5	22.5	24.0	25.5	25.0	26.0	25.5	28.0
60R	39	1585	33.5	13.0	12.5	13.0	13.5	14.0	16.5	17.5	18.0	18.0	19.0	20.0	20.5	21.5	22.0	23.0	24.0	25.5	27.0	28.0	28.5	29.0	28.0
132R	39	1551	34.5	12.0	12.0	12.0	12.0	13.0	15.5	16.5	17.0	18.0	18.5	19.0	20.0	20.0	21.0	21.5	23.0	23.0	24.5	26.5	28.0	28.5	27.5
146R	30	1635	36.0	12.5	11.5	11.0	11.5	13.0	14.0	15.0	18.0	19.0	19.0	17.5	17.0	18.5	19.0	21.0	24.0	26.0	26.5	27.5	29.0	28.5	28.0
158	50	1645	35.0	12.0	12.0	13.0	14.0	15.0	16.5	17.0	17.0	18.0	18.0	19.0	19.0	20.5	20.5	22.5	24.5	27.0	28.5	30.0	29.0	26.5	26.5
171R	29	1600	36.0	13.5	13.0	13.0	13.0	13.0	15.5	17.0	18.0	18.0	19.0	19.0	19.0	20.0	20.0	21.0	22.5	24.0	26.0	27.0	28.0	27.0	28.0
225	22	1740	36.0	12.5	13.0	13.0	13.5	15.0	17.0	17.0	17.0	19.0	18.5	19.0	19.0	19.5	20.0	21.0	22.5	24.0	27.0	27.5	28.0	28.5	28.0
272	49	1620	37.0	14.0	13.0	13.0	13.0	14.5	16.0	17.0	17.5	18.0	18.0	19.0	19.0	19.0	20.0	21.0	23.5	26.0	28.0	29.0	30.0	30.0	30.0
294R	33	1673	37.0	13.0	12.0	11.0	12.0	14.0	16.5	17.0	17.5	18.0	19.0	19.5	19.5	20.0	21.0	23.5	26.0	28.0	28.5	28.0	27.5	27.0	28.0
304	20	1625	36.0	12.5	13.0	13.0	13.0	14.0	15.5	16.5	16.0	17.0	17.0	17.0	18.5	19.5	21.0	21.5	22.5	25.0	26.0	26.5	27.5	26.5	26.5
323	23	1609	36.0	13.5	13.0	12.5	12.0	14.0	15.5	16.0	18.0	18.0	19.0	19.5	20.0	20.0	20.5	21.5	22.0	23.0	24.5	26.0	28.0	27.0	27.5
330	38	1601	35.0	12.0	11.5	12.5	12.5	13.0	15.0	17.0	17.5	18.0	18.5	19.5	19.0	20.5	20.5	22.0	23.0	25.0	26.0	27.0	27.0	27.0	28.5
341	38	1692	39.5	12.0	11.5	11.0	12.0	12.5	14.5	16.5	17.0	17.0	17.5	17.5	18.0	18.5	19.5	21.0	23.0	24.5	25.0	26.0	28.0	28.0	26.5
348R	28	1660	34.0	11.0	11.0	11.0	12.0	13.5	15.5	16.5	16.5	17.0	17.0	18.5	19.0	19.0	20.0	22.5	24.0	26.0	26.5	27.5	28.0	28.0	28.0
374R	47	1602	31.5	12.5	11.0	11.0	11.0	12.5	14.5	16.0	16.0	16.0	16.0	17.0	18.0	18.5	19.5	21.5	23.0	23.5	26.0	26.5	27.5	28.5	29.0
455	25	1592	35.5	14.0	14.0	13.5	13.0	13.5	15.5	16.0	17.0	17.5	18.0	19.0	20.0	20.0	20.0	21.0	22.0	23.0	26.0	27.0	28.5	28.0	28.0
457	19	1574	36.0	11.5	12.0	11.0	11.5	13.0	14.5	16.0	17.0	17.0	17.0	18.0	19.0	19.0	19.0	20.0	22.0	24.5	25.5	26.0	24.5	24.5	25.0
561	22	1563	29.0	12.5	11.5	11.0	12.0	13.0	15.0	16.5	17.0	18.0	17.0	18.0	19.0	19.0	19.5	20.5	21.0	23.0	24.0	26.0	27.0	26.5	27.0
568	27	1590	36.0	13.5	12.5	12.0	11.0	13.0	14.0	16.0	17.5	17.0	18.0	19.0	18.0	19.0	18.0	19.5	20.5	23.0	24.5	25.0	25.0	24.0	25.0
583	24	1540	37.5	14.5	14.0	13.0	13.5	14.0	16.0	17.0	18.0	17.5	19.0	18.0	19.5	19.0	20.0	21.5	24.0	25.0	26.5	29.0	31.0	30.0	30.0
584	40	1540	34.0	13.0	13.0	12.5	13.0	14.5	16.0	17.0	18.5	19.0	19.0	20.0	19.5	20.0	20.0	21.0	23.5	25.0	25.0	26.0	26.5	26.0	29.0

Table 2

MEASUREMENTS (CONTINUED)

ID#	AGE	HT	C2	C3	C4	C5	C6	C7	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	L1	L2	L3	L4	L5
586	40	1640	38.0	13.0	13.0	14.0	13.0	13.5	16.0	17.0	18.0	18.0	18.5	19.0	21.0	21.0	21.5	21.0	22.5	24.0	26.0	27.5	28.0	29.5	30.0
603	50	1745	37.5	14.0	13.5	13.0	13.5	14.0	16.0	18.0	19.0	19.0	18.5	20.0	20.0	20.5	20.0	21.0	22.0	25.0	27.5	29.0	29.0	30.0	29.0
610	39	1645	35.0	11.0	11.0	11.0	11.0	13.0	15.0	17.0	17.0	18.0	18.0	19.0	19.5	20.0	21.0	21.5	23.0	24.0	24.0	25.5	26.5	25.0	25.0
627	27	1620	35.5	11.0	11.5	11.5	12.0	14.0	16.5	17.5	18.0	18.5	18.5	19.0	20.0	21.0	21.0	22.0	23.5	24.5	27.0	28.0	28.0	28.0	29.0
632	27	1695	37.0	13.0	13.0	13.0	12.5	13.0	15.0	17.5	16.5	18.5	18.5	19.0	18.5	21.0	21.0	23.0	25.0	26.5	28.0	30.0	30.0	29.0	29.0
679	33	1460	30.0	12.0	12.5	12.0	12.0	12.5	15.0	16.0	16.5	17.0	17.5	17.5	18.0	19.0	20.0	19.0	22.0	24.5	26.5	26.0	26.0	27.0	28.0
723	22	1641	34.0	11.0	10.5	11.0	11.0	12.0	14.5	16.0	16.5	17.0	17.0	17.0	17.5	18.0	18.0	20.5	21.5	24.0	24.5	26.0	26.5	26.5	28.0
729	31	1645	35.0	11.0	11.0	11.0	12.0	14.0	17.0	18.5	18.0	17.0	18.0	19.0	20.0	20.5	21.0	21.0	22.0	24.0	25.0	25.0	27.0	28.0	27.0
738	43	1630	35.0	13.0	12.5	12.0	12.0	14.0	16.0	16.5	17.0	18.0	18.0	18.5	19.5	20.0	20.5	21.5	22.5	24.5	26.0	26.0	25.0	25.0	27.5
774	33	1655	38.0	14.0	13.5	13.0	13.0	14.5	17.0	17.5	18.0	18.5	19.0	20.0	20.0	20.0	21.0	23.0	25.0	27.0	28.0	28.0	28.0	28.0	28.5
815	32	1700	32.5	12.5	12.0	13.0	12.5	14.0	16.0	18.0	18.0	18.0	19.5	19.0	20.0	20.5	22.0	21.5	20.5	23.5	25.0	27.0	29.0	29.0	29.0
824	30	1620	33.0	12.0	12.0	11.5	12.0	13.0	15.0	16.5	18.0	18.0	18.5	19.0	19.0	19.0	19.5	20.0	21.0	23.0	25.0	25.0	25.0	27.5	27.0
840	32	1615	36.5	13.0	12.5	13.0	13.0	13.0	15.0	16.5	17.0	17.5	18.0	18.5	19.0	19.0	19.5	20.5	21.5	23.5	25.0	26.0	27.0	27.0	27.0
844	26	1630	34.0	13.0	13.0	13.0	12.5	14.0	15.5	16.0	17.0	17.0	17.5	18.0	19.0	19.0	20.5	21.0	22.0	25.5	26.5	26.0	25.5	25.5	26.0
873	48	1614	37.0	13.0	12.5	12.0	12.0	13.5	15.5	18.0	18.5	18.5	19.0	19.5	20.5	20.5	20.0	22.0	23.5	25.0	25.0	26.0	27.0	27.5	29.0
885	23	1670	34.5	13.0	12.0	12.0	13.0	13.5	16.0	17.0	17.5	18.0	19.0	18.0	19.0	19.0	20.0	21.5	23.0	25.0	26.5	27.0	29.0	29.0	29.0
891	39	1724	38.0	13.5	14.0	14.0	13.5	14.0	17.0	19.0	19.0	19.5	20.0	20.0	20.0	19.5	21.0	23.0	24.5	27.0	29.0	29.0	28.5	29.0	28.5
900R	42	1720	39.5	12.5	11.5	12.0	13.0	14.0	15.5	17.0	17.0	18.0	19.0	19.0	19.0	19.0	20.0	21.0	23.0	25.0	26.5	26.5	28.0	28.0	27.0
905	22	1550	37.0	13.0	13.0	12.5	12.5	13.5	15.5	16.5	17.0	17.0	17.5	18.0	18.5	19.0	19.0	20.0	22.0	24.0	27.5	29.0	29.0	28.5	27.0
913	27	1690	35.0	11.0	11.0	11.0	11.0	12.5	15.0	15.5	15.0	16.0	16.0	16.5	17.5	18.0	18.0	20.0	21.0	23.5	25.0	26.5	27.5	28.5	28.0
920	36	1500	35.0	13.0	12.0	12.0	13.0	13.0	14.5	15.0	15.0	16.0	15.0	17.0	17.5	18.0	18.0	18.5	19.0	20.5	21.5	23.0	21.5	27.0	27.5

Table 2

MEASUREMENTS (CONTINUED)

ID#	AGE	HT	C2	C3	C4	C5	C6	C7	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	L1	L2	L3	L4	L5
921	38	1685	35.0	12.0	12.5	12.0	12.0	14.0	16.0	17.0	18.0	19.0	18.5	20.0	20.0	20.5	21.5	23.0	25.0	26.5	27.0	27.0	28.5	28.0	27.0
927	35	1615	38.5	13.0	12.0	12.0	12.5	14.0	16.5	18.0	18.5	18.5	19.0	19.5	20.0	20.0	21.0	22.0	24.0	26.0	26.0	26.0	26.0	26.0	27.0
929	20	1680	36.0	12.5	12.5	13.0	12.0	13.5	15.0	17.0	18.5	18.0	18.5	19.0	19.0	20.0	20.0	21.0	23.0	24.0	26.0	27.0	28.5	28.0	27.0
940	39	1540	36.0	13.0	13.0	12.0	13.0	14.0	16.0	17.0	17.0	18.0	18.0	19.0	19.0	20.0	20.0	21.0	21.0	23.0	25.0	26.0	26.0	26.0	26.0
949	24	1730	34.0	12.0	12.0	13.0	12.5	13.0	15.0	17.0	18.0	18.0	18.5	19.5	20.0	20.5	20.0	21.0	23.0	25.5	27.0	28.0	28.0	27.5	27.0
952	41	1530	33.5	11.5	11.0	11.0	11.0	12.0	14.5	16.0	16.5	17.0	16.5	17.5	18.5	18.5	18.5	20.0	21.0	23.0	24.0	25.5	26.0	26.0	26.0
959	46	1655	35.5	11.5	11.0	11.0	11.0	13.0	15.0	16.0	17.0	17.0	17.0	19.0	20.0	20.5	21.0	22.0	23.0	24.0	25.5	25.5	26.5	28.0	27.0
978	46	1755	37.5	14.0	13.5	13.0	13.0	15.0	18.0	18.0	18.5	19.0	19.0	20.0	20.0	20.0	20.5	22.0	24.0	26.0	27.0	27.5	28.0	28.5	28.0
988	40	1590	34.0	12.5	11.5	11.0	11.5	12.0	14.0	16.0	18.0	17.0	17.0	19.0	19.0	19.5	20.0	21.0	23.0	24.0	26.0	28.0	28.0	27.5	30.0
994	30	1770	36.0	13.0	12.0	12.0	13.0	15.0	17.0	18.0	18.0	18.0	19.0	19.0	19.5	20.0	21.0	22.5	24.0	26.5	27.5	27.5	30.0	31.0	30.0
995	38	1765	38.0	12.0	11.0	12.0	12.0	13.5	16.0	17.5	18.0	18.0	19.0	20.0	21.0	21.0	21.0	23.0	24.0	26.0	27.5	30.0	29.5	29.0	29.0
1004	42	1690	36.5	12.0	13.5	13.0	13.5	14.5	15.5	16.5	17.0	18.0	18.5	19.0	19.0	20.0	20.5	22.0	22.5	25.0	26.5	27.5	27.5	28.5	27.5
1010	25	1640	37.0	13.0	12.0	11.5	13.0	13.5	16.0	17.0	17.5	18.0	19.0	19.0	20.0	20.5	21.0	22.0	23.0	26.0	28.0	27.0	29.0	28.0	27.5
1015	41	1590	33.0	12.0	12.0	12.0	13.0	14.0	15.5	16.5	17.0	18.0	18.5	19.5	20.0	21.0	22.0	23.0	24.5	25.0	26.0	26.5	26.5	25.0	25.5
1027	41	1590	33.5	13.0	11.5	11.5	11.5	13.0	17.0	17.5	18.0	18.5	18.5	19.0	19.5	20.0	21.0	22.0	22.5	24.0	24.5	25.5	26.5	27.0	27.5
1032	21	1650	35.5	13.0	13.5	13.0	13.0	13.0	15.5	17.0	17.0	17.0	17.0	17.5	18.0	19.0	20.0	21.0	22.5	25.0	27.0	28.0	28.0	29.0	27.0
1034	43	1690	40.0	13.0	13.0	13.5	14.5	15.5	17.5	18.5	19.0	19.0	20.0	20.5	21.0	21.0	23.0	24.0	26.0	28.0	29.5	31.5	30.0	29.0	28.5
1042R	39	1700	35.0	13.0	13.0	13.0	13.5	14.5	16.0	18.0	18.0	18.0	19.0	20.0	20.5	21.0	20.5	22.5	24.0	25.0	27.0	28.0	30.0	30.0	29.0
1064	33	1650	38.5	13.0	12.5	13.0	13.0	14.0	16.5	17.5	18.0	18.0	18.0	19.0	20.0	20.0	20.0	21.5	23.0	24.0	26.0	27.5	28.0	27.0	27.5
1076	26	1600	33.0	11.0	11.5	12.0	12.0	14.0	16.0	16.0	17.0	17.5	18.0	19.0	18.5	20.0	20.0	22.0	25.0	27.0	27.0	27.5	28.5	27.0	25.0
1083	40	1620	35.0	12.0	12.0	12.0	12.5	13.5	15.0	16.0	16.0	16.5	17.0	17.0	18.0	18.0	19.0	20.0	22.0	22.0	24.0	24.5	24.5	24.0	25.0

Table 2

MEASUREMENTS (CONTINUED)

ID#	AGE	HT	C2	C3	C4	C5	C6	C7	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	L1	L2	L3	L4	L5
1092	36	1590	36.0	13.0	11.0	11.0	11.5	12.5	14.5	16.0	17.5	17.5	17.0	19.0	19.0	19.0	21.5	20.0	23.0	24.5	26.0	27.0	26.0	28.5	28.0
1096	48	1550	33.5	12.0	12.0	12.0	12.0	14.5	15.0	16.5	17.0	17.0	17.0	17.5	18.5	19.0	19.5	19.5	20.5	22.5	24.5	25.5	26.0	27.0	27.0
1127	46	1500	32.0	12.0	12.0	11.5	11.5	12.5	14.0	15.0	15.5	16.0	16.0	16.5	17.0	16.5	17.0	19.0	20.0	21.0	23.0	24.0	25.0	25.5	24.0
1150	39	1515	33.0	10.5	10.5	10.5	10.5	12.0	15.0	16.0	18.0	18.5	18.0	18.0	18.0	18.5	19.0	19.0	20.0	21.0	23.0	24.5	23.0	25.0	27.0
1163	41	1597	37.0	13.0	12.0	12.0	12.0	13.0	15.0	17.0	17.5	17.0	18.5	19.5	19.0	20.0	20.0	22.0	23.0	25.0	26.0	26.0	26.0	27.0	27.0
1164	27	1570	35.0	12.5	11.5	11.0	10.5	13.0	16.0	16.5	16.5	17.0	17.0	17.5	18.0	18.5	19.5	20.5	22.5	24.5	26.0	27.5	27.0	26.0	26.5
1173	30	1675	36.5	12.5	12.0	13.0	13.0	14.0	16.5	17.5	17.0	17.0	17.5	18.0	17.5	17.0	18.0	21.5	21.0	24.5	25.5	26.0	26.5	25.0	26.0
1182	48	1672	36.5	13.5	13.0	12.0	12.0	14.0	16.0	17.5	17.0	17.0	18.0	18.0	19.0	20.0	21.0	22.5	24.5	25.5	27.0	28.0	29.0	29.0	29.0
1198	42	1650	34.5	12.0	11.5	11.0	12.0	13.0	15.5	16.5	16.5	16.5	17.0	17.5	18.0	19.0	20.0	21.0	23.5	24.0	24.5	25.0	24.5	25.0	26.0
1209	46	1670	35.5	12.0	13.0	12.5	13.0	13.5	15.5	17.0	17.5	18.5	19.0	19.0	19.0	20.0	20.5	21.0	23.0	23.5	25.0	24.5	26.5	26.0	26.0
1211	27	1470	31.5	12.0	12.0	12.0	12.0	13.0	14.5	16.5	16.0	16.0	17.0	17.5	18.0	19.0	19.5	20.5	22.0	23.5	25.5	26.5	27.0	27.0	28.0
1215	25	1610	34.0	12.0	11.0	11.0	11.5	12.0	14.5	16.5	16.5	17.0	18.0	18.5	19.0	19.0	19.5	21.0	21.5	22.0	23.5	25.0	26.0	26.5	28.0
1222	29	1630	35.5	12.0	12.0	12.0	12.5	13.0	15.0	16.5	16.5	17.0	16.5	16.5	17.0	16.5	18.0	20.0	21.5	23.5	26.0	27.0	28.0	26.5	27.0
1236	36	1700	37.0	15.0	14.0	14.0	14.0	15.0	17.5	18.0	18.5	18.5	19.0	20.0	21.0	22.0	22.0	23.0	24.0	26.0	28.0	29.0	29.0	29.0	30.0
1244	38	1672	35.0	11.0	12.0	11.5	12.0	14.0	16.0	18.0	18.0	18.0	18.5	19.5	20.0	20.5	21.0	23.0	25.0	26.5	28.0	29.5	29.0	29.0	29.5
1240R	40	1534	36.0	13.0	12.0	12.0	12.0	12.5	14.0	17.0	17.5	17.5	18.0	18.0	18.5	19.5	19.5	21.0	22.0	23.0	24.5	25.5	27.0	26.0	25.0
1265	26	1650	37.0	12.0	12.0	11.5	11.5	13.0	15.5	17.0	17.0	17.0	18.0	18.0	19.0	19.0	20.5	22.0	24.0	25.0	26.5	27.5	28.0	26.0	26.5
1287	24	1700	36.0	13.0	12.5	12.0	13.0	15.0	17.0	18.0	18.5	18.5	19.0	20.0	20.0	20.0	21.0	22.0	24.0	26.0	27.0	28.0	29.5	29.0	28.0
1333	32	1600	35.0	12.0	12.5	12.0	12.5	14.0	15.5	17.0	16.5	17.0	17.5	18.0	19.0	19.5	20.0	20.5	22.0	23.0	24.5	26.5	26.0	27.0	27.0
1347	39	1525	35.0	12.5	12.0	12.0	12.5	14.0	15.5	17.0	18.0	18.0	19.0	20.0	20.5	21.0	23.0	21.0	24.0	26.0	27.5	28.5	27.5	26.0	26.0
1351	34	1710	36.0	13.5	14.0	13.5	13.0	12.5	15.0	17.5	17.0	17.0	18.0	18.0	19.0	19.0	20.5	23.5	25.5	26.0	27.0	27.5	27.0	27.0	26.5

Table 2

MEASUREMENTS (CONTINUED)

ID#	AGE	HT	C2	C3	C4	C5	C6	C7	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	L1	L2	L3	L4	L5
1354	25	1700	36.0	12.0	11.5	12.0	12.0	13.0	16.0	17.0	17.5	17.0	18.0	18.0	19.0	20.0	20.0	21.0	22.5	23.0	25.5	26.0	27.0	27.0	27.5
1393	41	1640	37.5	12.0	12.0	12.0	13.0	14.5	16.5	18.5	18.0	18.0	18.0	17.5	17.0	18.5	20.0	20.0	21.5	23.0	24.0	25.5	26.5	26.0	26.5
1396	28	1550	34.0	12.0	11.5	11.0	11.0	12.5	14.5	16.0	16.5	17.0	17.5	18.0	19.0	19.0	20.0	21.0	22.0	23.0	25.0	27.0	26.5	27.5	28.0
1413	27	1715	39.5	13.0	13.0	13.0	13.5	15.0	17.5	18.0	19.0	19.0	20.0	20.0	20.5	21.0	21.0	22.0	22.5	26.0	27.5	28.0	30.5	30.0	32.0
1414R	40	1737	35.0	12.0	12.0	12.0	12.0	13.0	16.0	17.0	18.0	17.5	18.0	19.0	19.5	19.5	20.0	21.0	22.5	25.0	27.0	27.0	27.5	27.0	27.0
1417	37	1620	42.0	16.0	14.0	13.0	14.0	15.0	17.0	17.5	18.5	19.5	20.0	20.5	21.5	21.0	21.5	22.5	23.0	24.5	27.0	27.5	29.0	27.5	29.5
1420	49	1655	34.5	13.0	13.0	13.0	12.0	14.0	16.5	17.5	18.0	18.5	18.5	20.0	20.5	21.0	21.5	23.5	25.0	27.0	28.0	27.0	29.0	29.0	29.0
1434R	19	1600	36.0	12.0	11.5	11.0	12.0	13.0	15.0	15.0	13.5	12.0	15.5	16.5	17.0	19.0	19.0	20.0	21.0	23.5	26.0	25.0	27.0	26.0	26.5
1464	45	1537	34.5	10.5	10.5	11.0	10.5	12.0	14.0	15.5	16.0	17.0	18.0	18.0	18.5	18.0	19.0	20.0	21.5	23.5	23.5	23.5	24.0	25.0	26.5
1468	41	1675	36.0	11.5	11.5	11.5	12.0	13.5	16.0	16.5	17.0	17.5	19.0	20.0	20.5	21.0	22.0	22.5	23.5	26.0	26.5	28.0	28.0	27.0	27.5
1500	24	1560	35.0	11.5	11.5	12.0	12.0	13.5	15.0	16.0	16.5	17.0	17.5	18.0	18.5	18.0	18.5	20.0	22.0	23.0	25.0	25.0	25.5	25.0	28.5
1507	23	1749	38.5	14.0	14.0	13.5	13.5	14.5	17.0	18.0	19.0	19.5	19.5	20.5	21.0	21.0	22.0	23.5	25.0	28.0	29.5	31.0	32.0	32.0	29.0
1509	30	1575	37.0	13.5	13.5	13.0	14.0	13.5	15.5	17.0	17.0	17.5	17.5	18.0	19.0	19.5	19.5	20.5	22.0	23.5	25.0	26.5	28.0	27.0	26.5
1515	43	1582	36.5	13.5	13.0	14.0	14.0	14.0	17.0	17.5	17.5	17.5	18.0	19.0	18.8	19.0	19.5	21.5	22.0	23.0	25.0	25.5	27.0	26.0	28.0
1553	30	1498	31.0	12.5	11.0	11.0	12.0	12.0	14.0	15.0	15.0	15.5	16.5	16.0	17.0	17.0	18.0	19.0	21.0	22.0	24.0	24.0	25.0	26.0	24.5
1555	41	1660	34.5	12.0	12.0	12.0	12.0	14.0	16.0	17.5	18.5	18.5	19.0	19.5	20.0	21.0	21.0	21.5	23.0	24.5	26.0	26.0	27.5	28.0	26.0

three at a time (C2, C3, C4; C3, C4, C5; C4, C5, C6; etc.), until all 23 are taken together. Only continuous sections of the vertebral column are included, i.e., combinations such as "C2, C3, C7" are not included. There are a total of 276 bone-groups developed by this method. They are referred to in this paper by their starting and ending vertebrae. For example, L2-L2 would represent the bone-group which consists of the single vertebra L2, while L2-L5 represents the bone-group consisting of the four vertebrae L2, L3, L4, and L5.

All measurements were made by the author and a certain amount of bias is evident by looking at the height distribution of an individual vertebra (see Figure 3). This bias was due to a tendency to report the height to the nearest whole millimeter and to report half-millimeters only when the height was very near to being exactly on a half-millimeter. This, however, should not substantially effect the outcome of this research since such bias should increase the standard deviations slightly without significantly effecting the means of the measurements. This bias does not affect the means of the bone-groups because it is self-eliminating when large numbers of measurements are involved.

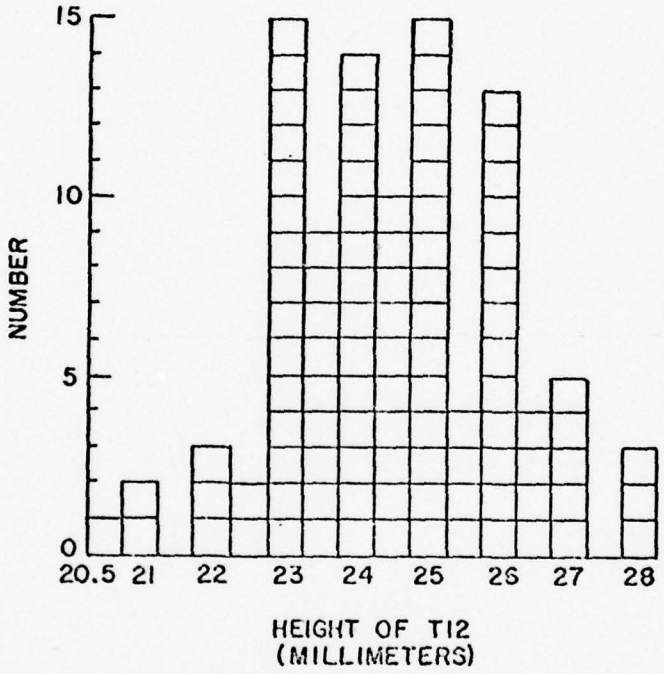

FIG. 3 DISTRIBUTION OF T 12 AMONG 100 NEGRO FEMALES

IV. STATISTICAL ANALYSIS

The analysis of the data followed the method set forth by Pearson (1898). In order to utilize the linear regression method, it is necessary to make three assumptions: 1) that the material being studied is a sample (not necessarily random) from a large population; 2) that the stature and bone heights are random variables from that population; and 3) that the relationship between the stature and bone heights is linear.

The first of these assumptions is not a problem since the large population from which the sample came is the whole adult Negro population of the United States. The second assumption falls short of fulfillment because Terry himself admitted in 1940 that a sample from the dissecting room is not representative of the general population due to long term illness and malnutrition in many cases and due to dehydration of the body after death. Terry, however, went on to point out that, while the transverse body measurements are effected by these conditions, the longitudinal measurements remain uneffected. In reviewing Trotter and Gleser's work with the Terry Collection (1951a, 1951b, 1952) nothing was found which would indicate that the collection is not a random sample of the general population as far as the longitudinal measurements are concerned. The third assumption has no factual basis. When using regression analysis it is necessary to assume a form for the regression line before beginning. The analysis indicates how well the assumed line fits the data but does not indicate whether another form of line (such as quadradic or cubic) would have a better fit with the data. The matter of the choice of a straight line will be addressed again later in this paper.

In order to apply regression analysis to the data, the stature is designated $X_{0j}(j=1,2,\ldots,n)$ and the bone-group lengths as $X_{ij}(i=1,2,\ldots,k;\ j=1,2,\ldots,n)$, where "i" is the bone-group number, "k" is the number of bone-groups (in this case 276), "j" designates the individual skeleton, and "n" is the total number of skeletons (in this case 100).

The following equations can then be utilized to obtain the desired regression formulae:

1. The mean stature and the mean length for each bone-group,

$$\bar{X}_i = (1/n)\sum_{j=1}^{n} X_{ij}$$

2. The standard deviation of the stature and of the bone-group lengths,

$$\sigma_i = \sqrt{(1/(n-1))\sum_{j=1}^{n}((X_{ij}-\bar{X}_i)^2)}$$

3. The product moment between the stature and the bone-group "i",

$$\mu_{0i} = (1/(n-1))\sum_{j=1}^{n}((X_{0j}-\bar{X}_0)(X_{ij}-\bar{X}_i))$$

4. The coefficient of correlation between the stature and the bone-group "i",

$$\rho_{0i} = \mu_{0i}/(\sigma_i\sigma_0)$$

5. The regression coefficient between the stature and the bone-group "i",

$$\beta_{0i} = \rho_{0i}(\sigma_0/\sigma_i)$$

6. The regression formula for estimation of stature based on a given bone-group X_i,

$$X_0^i = \bar{X}_0+\beta_{0i}(X_i-\bar{X}_i)$$

7. The standard error of the estimate X_0^i,

$$\sigma_{0i} = \sigma_0\sqrt{1-\rho_{0i}^2}$$

The actual stature would be expected to fall in the range $X_0^i \pm \sigma_{0i}$ approximately 68% of the time and in the range $X_0^i \pm 2\sigma_{0i}$ approximately 95% of the time.

Since each of the above values ($\bar{X}_i$, σ_i, ρ_{0i}, β_{0i} and σ_{0i}) are derived from a sample, they are random variables which estimate the true values for the population. The standard error for each of these estimates can be obtained from the following:

1. $\varepsilon(\bar{X}_i) = \sigma_i/\sqrt{n}$
2. $\varepsilon(\sigma_i) = \sigma_i/\sqrt{2n}$
3. $\varepsilon(\rho_{0i}) = (1-\rho_{0i}^2)/\sqrt{n}$
4. $\varepsilon(\beta_{0i}) = \sigma_{0i}/(\sigma_i\sqrt{n})$
5. $\varepsilon(\sigma_{0i}) = \sigma_{0i}/\sqrt{2n}$

V. THE COMPUTER SYSTEM

The statistical analysis for this project was carried out using a Hewlett Packard model 2108 mini-computer with core memory capability of 32,000 words of 16 bits each. The computer system consisted of:

1) a Real-Time Executive II operating system; 2) one Hewlett Packard 7900 discdrive sybsystem capable of utilizing three platters of 3.0 Megabytes each; 3) one Advanced Engineering Design model 6200 discdrive subsystem capable of utilizing four floppy discs of 3/4 Megabytes each; 4) one 9 track magtape reader capable of 800 flux changes per inch; 5) one paper tape punch capable of punching 75 characters per second; 7) one Versatex model 1110A lineprinter capable of printing 1000 lines per minute with a resolution of 100 dots per inch; 8) one Hewlett Packard 2600 terminal; 9) one Silent 700 hardcopy terminal; 10) one Teletype; 11) two Hewlett Packard 2615 terminals; and 12) one cardreader capable of reading 600 cards per minute.

VI. THE COMPUTER PROGRAMMING

Due to the limited amount of core memory available, it was necessary to perform the statistical analysis in stages and to store the intermediate results in storage files on the disc. Each storage file name consists of four letters to identify the type of information in the file, followed by either MA of FE, according to which sex the data represents. For example, the original data (which consists of the body identification number, age, stature, and heights of the individual vertebrae for each subject in the sample) is stored in BONEMA and BONEFE. For the purpose of simplicity, the storage files will be referred to only by the first four letters.

The source files which create the compiled programs used in the analysis are named with a "$" followed by five letters to identify the purpose of the program. The program which is created is named with the five letters used to identify the source file. For example, $GNSEC is the source file which creates the program GNSEC. The program GNSEC generates the 276 sections of the vertebral column which are the random variables that are analyzed. The flow chart in Figure 4 shows the relationships between the source files, programs, storage files, and output. Listings of the programs are provided in appendix A.

The program LISTS is strictly a formating program. It reads the files containing the bone length data and formats them into a readable form.

The program GNSEC reads the bone length data from storage file BONE and, as previously stated, generates the 276 bone-group lengths for each skeleton. This is then stored in file SECS. An example of the output generated by this program is contained in appendix B.

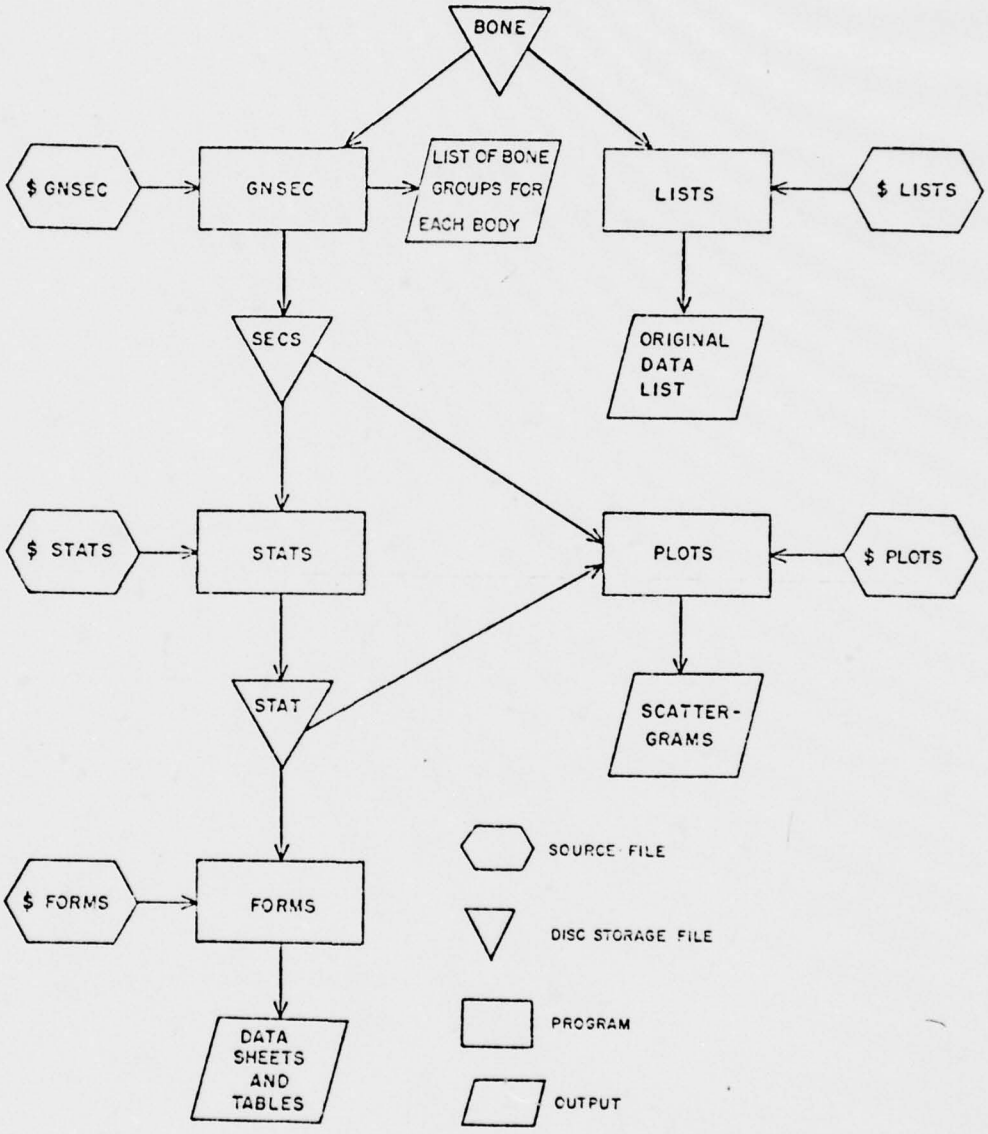

FIG. 4 COMPUTER PROGRAM FLOW CHART

The next program, STATS, is the main program in the system. It does the statistical analysis using the data contained in SECS. In addition to the analysis of the entire data set, the program is designed so that age limits may be placed on the data to be evaluated. In this way it is possible to evaluate different age ranges without changing any of the files. The program also divides the data into age and height groups if desired. STATS produces no written output. Instead it stores all of its output in the file STAT for use by two other programs.

The first program that utilizes the file STAT is FORMS. This program, like LISTS, is strictly a formating program. It retreives the information from STAT and prints it out in two tables in readable form.

The second program that utilizes the file STAT is PLOTS. In addition to obtaining information from STAT, PLOTS also retrieves information from the file SECS and creates a scattergram for each bone-group, which shows the data points, the regression line, and one standard deviation above and below the regression line.

VII. RESULTS

The data obtained from the previously described skeletons was subjected to regression analysis as set forth above. The results of this analysis are shown in tables 3 and 4. These tables give the mean and standard deviation of stature and of each bone-group, along with the coefficient of correlation and regression coefficient for each bone-group as it relates to stature. The tables also provide the standard error of the stature estimation equation for each bone-group, as well as standard errors of each of the above statistics.

After correcting for age, the mean cadaver statures are 1744.70mm for the males and 1630.06mm for the females. These means were compared with the mean statures obtained by Trotter and Gleser (1952) from Terry Collection material and various other researchers from non-Terry Collection material (Dupertuis and Hadden, 1951).

There was no statistically significant* difference between the mean statures found in this study and those found by Trotter and Gleser.**

The mean stature of the females in this study was not significantly different from that reported on non-Terry Collection subjects.*** The male

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*In this study, a difference is considered to be statistically significant when $P<.05$ using a two-tailed test. For the remainder of this paper the term significant refers to statistical significance.

**The mean statures found by Trotter and Gleser were equivalent to living statures. Their means were converted to cadaver statures by adding 2.5cm prior to any comparisons.

***Non-Terry Collection subjects consisted of both living persons and cadavers. To maximize the size of the sample the average stature of the living subjects was determined. This figure was converted to cadaver stature by adding 2.5cm and was then averaged with the cadavers. This provided a sample of 2,123 Negro females and 8,471 males.

Table 3

STATISTICAL ANALYSIS -- NEGRO MALES

THIS TABLE GIVES THE MEAN AND STANDARD DEVIATION (SD) FOR THE STATURE AND BONE-GROUP LENGTHS ALONG WITH THE CORRELATION COEFFICIENT (CC), REGRESSION COEFFICIENT (RC), AND THE STANDARD ERROR OF THE ESTIMATE (SDE) FOR EACH OF THE BONE-GROUPS. THE ESTIMATED ERRORS OF EACH OF THE ABOVE ARE ALSO PROVIDED. ALL MEASUREMENTS ARE IN MILLIMETERS.

STATURE: MEAN = 1744.70 (+-) 6.99 STANDARD DEVIATION = 89.85 (+-) 4.94

BONE-GROUP	MEAN	(+-)	SD	(+-)	CC	(+-)	RC	(+-)	SDE	(+-)
C2 C2	38.00	.26	2.57	.18	.53	.07	14.30	2.31	59.40	4.20
C3 C3	13.89	.13	1.29	.09	.24	.09	12.80	5.28	67.89	4.80
C4 C4	13.45	.11	1.10	.08	.28	.09	17.56	6.12	67.14	4.75
C5 C5	13.08	.11	1.12	.08	.31	.09	19.11	5.96	66.52	4.70
C6 C6	13.19	.11	1.15	.08	.30	.09	18.20	5.80	66.64	4.71
C7 C7	14.53	.12	1.17	.08	.31	.09	18.25	5.70	66.53	4.70
T1 T1	16.94	.12	1.22	.09	.36	.09	20.57	5.34	65.19	4.61
T2 T2	18.32	.12	1.19	.08	.41	.08	23.92	5.37	63.81	4.51
T3 T3	18.70	.11	1.09	.08	.49	.08	30.90	5.58	61.08	4.32
T4 T4	18.35	.11	1.14	.08	.42	.08	25.79	5.58	63.41	4.48
T5 T5	19.45	.13	1.35	.10	.36	.09	18.92	4.83	65.04	4.60
T6 T6	20.12	.14	1.36	.10	.37	.09	19.17	4.77	64.82	4.58
T7 T7	20.63	.13	1.27	.09	.32	.09	17.46	5.20	66.23	4.68
T8 T8	21.05	.12	1.24	.09	.38	.09	21.34	5.19	64.61	4.57
T9 T9	21.58	.12	1.16	.08	.38	.09	22.76	5.59	64.69	4.57
T10 T10	22.78	.14	1.38	.10	.42	.08	21.00	4.60	63.54	4.49
T11 T11	24.42	.14	1.43	.10	.49	.08	23.75	4.26	61.82	4.31
T12 T12	26.19	.15	1.47	.10	.53	.07	25.12	4.04	59.32	4.19
L1 L1	27.47	.15	1.45	.10	.58	.07	28.16	3.91	56.68	4.02
L2 L2	27.72	.15	1.46	.10	.58	.07	27.84	3.88	56.74	4.01
L3 L3	27.90	.17	1.66	.12	.56	.07	23.59	3.49	57.85	4.09
L4 L4	27.86	.18	1.79	.13	.56	.07	21.26	3.27	58.54	4.14
L5 L5	28.28	.19	1.94	.14	.31	.09	11.10	3.42	66.40	4.70
C2 C3	51.97	.35	3.47	.25	.48	.08	9.63	1.77	61.36	4.34
C3 C4	27.34	.23	2.26	.16	.27	.09	8.29	2.90	67.30	4.76
C4 C5	26.53	.21	2.12	.15	.30	.09	10.01	3.14	66.56	4.71
C5 C6	26.26	.22	2.17	.15	.32	.09	10.15	3.05	66.29	4.69
C6 C7	27.72	.22	2.23	.16	.31	.09	9.81	2.97	66.33	4.69
C7 T1	31.47	.22	2.23	.16	.36	.09	11.10	2.93	65.26	4.61
T1 T2	35.26	.22	2.23	.16	.41	.08	13.91	2.85	63.58	4.50

Table 3

STATISTICAL ANALYSIS -- NEGRO MALES
(CONTINUED)

BONE-GROUP	MEAN	(+-)	SD	(+-)	CC	(+-)	PC	(+-)	SDE	(+-)
T2 T3	37.10	.22	2.17	.15	.47	.08	15.06	2.95	61.74	4.37
T3 T4	37.73	.21	2.14	.15	.47	.08	15.41	2.88	61.60	4.36
T4 T5	38.41	.23	2.34	.17	.41	.08	12.32	2.71	62.61	4.56
T5 T6	39.58	.25	2.52	.18	.40	.08	10.94	2.54	64.16	4.54
T6 T7	40.75	.25	2.54	.19	.36	.09	9.84	2.56	65.22	4.61
T7 T8	41.68	.24	2.44	.17	.36	.09	10.26	2.67	65.20	4.61
T8 T9	42.62	.23	2.30	.16	.40	.08	11.99	2.79	64.17	4.54
T9 T10	44.36	.24	2.41	.17	.42	.08	12.16	2.63	63.41	4.48
T10 T11	47.19	.27	2.68	.19	.47	.08	12.38	2.30	61.48	4.35
T11 T12	50.51	.28	2.81	.20	.52	.07	12.99	2.12	59.53	4.21
T12 L1	53.57	.28	2.82	.20	.58	.07	14.31	2.03	57.80	4.09
L1 L2	55.28	.28	2.79	.20	.61	.06	15.22	1.98	55.41	3.92
L2 L3	55.71	.30	3.00	.21	.60	.06	13.87	1.87	56.13	3.97
L3 L4	56.85	.33	3.38	.23	.58	.07	12.27	1.73	56.96	4.03
L4 L5	56.12	.36	3.55	.25	.44	.08	8.74	1.76	62.57	4.42
C2 C4	65.42	.43	4.29	.30	.46	.08	7.48	1.45	62.15	4.39
C3 C5	40.42	.32	3.25	.23	.29	.09	6.27	2.06	66.82	4.73
C4 C6	39.71	.31	3.13	.22	.32	.09	7.04	2.12	66.28	4.69
C5 C7	40.79	.32	3.22	.23	.32	.09	7.01	2.05	66.11	4.67
C6 T1	44.67	.32	3.21	.23	.35	.09	7.72	2.03	65.31	4.62
C7 T2	49.79	.32	3.17	.22	.40	.08	8.80	2.02	63.93	4.52
T1 T3	54.04	.31	3.14	.22	.46	.09	10.32	1.97	61.91	4.38
T2 T4	56.05	.31	3.14	.22	.47	.08	10.54	1.96	61.50	4.35
T3 T5	57.19	.33	3.29	.23	.46	.08	9.69	1.89	62.16	4.40
T4 T6	58.53	.35	3.53	.25	.42	.08	8.26	1.80	63.48	4.49
T5 T7	60.21	.37	3.66	.26	.38	.09	7.33	1.76	64.51	4.56
T6 T8	61.80	.37	3.68	.26	.38	.09	7.12	1.76	64.74	4.58
T7 T9	63.25	.35	3.47	.25	.38	.09	7.64	1.86	64.64	4.57
T8 T10	65.40	.35	3.50	.25	.42	.08	8.47	1.81	63.26	4.47
T9 T11	68.77	.37	3.66	.26	.47	.08	8.91	1.69	61.77	4.37
T10 T12	73.29	.40	4.01	.28	.51	.07	8.90	1.50	60.06	4.25
T11 L1	77.90	.41	4.09	.29	.57	.07	9.67	1.41	57.55	4.07
T12 L2	81.29	.41	4.08	.29	.61	.06	10.39	1.36	55.52	3.93
L1 L3	83.18	.43	4.28	.30	.62	.06	10.05	1.29	55.06	3.89
L2 L4	83.57	.46	4.59	.32	.60	.06	9.14	1.21	55.82	3.95
L3 L5	84.10	.49	4.95	.35	.51	.07	7.16	1.22	60.20	4.26
C2 C5	78.40	.52	5.28	.37	.44	.08	5.88	1.20	62.73	4.44
C3 C6	53.61	.42	4.25	.30	.38	.09	4.99	1.57	66.55	4.71
C4 C7	54.25	.41	4.14	.29	.32	.09	5.49	1.68	66.07	4.67
C5 T1	57.74	.41	4.15	.29	.36	.09	6.88	1.57	65.26	4.61
C6 T2	62.99	.41	4.11	.29	.40	.08	6.72	1.56	64.17	4.54

Table 3

STATISTICAL ANALYSIS -- NEGRO MALES
(CONTINUED)

BONE-GROUP	MEAN	(+-)	SD	(+-)	CC	(+-)	RC	(+-)	SDE	(+-)
C7 T3	68.57	.40	4.04	.29	.45	.00	7.75	1.55	62.45	4.42
T1 T4	72.89	.40	4.05	.29	.48	.00	8.24	1.52	61.40	4.34
T2 T5	75.51	.42	4.24	.30	.47	.00	7.70	1.46	61.74	4.37
T3 T6	77.31	.45	4.45	.32	.45	.00	7.04	1.40	62.40	4.41
T4 T7	79.15	.46	4.65	.33	.40	.00	6.07	1.37	63.09	4.52
T5 T8	81.26	.47	4.74	.34	.40	.00	5.83	1.35	64.15	4.54
T6 T9	83.37	.47	4.68	.33	.39	.00	5.82	1.38	64.34	4.55
T7 T10	86.04	.46	4.63	.33	.41	.00	6.15	1.38	63.77	4.51
T8 T11	89.82	.47	4.79	.33	.46	.00	6.91	1.32	61.86	4.37
T9 T12	94.87	.44	4.95	.35	.50	.07	7.09	1.22	60.41	4.27
T10 L1	100.76	.52	5.23	.37	.55	.07	7.38	1.11	58.20	4.12
T11 L2	105.71	.53	5.32	.38	.60	.06	7.85	1.05	56.03	3.96
T12 L3	109.28	.55	5.52	.39	.62	.06	7.80	1.00	54.98	3.89
L1 L4	111.84	.58	5.83	.41	.62	.06	7.41	.94	54.87	3.89
L2 L5	111.83	.62	6.18	.44	.54	.07	6.16	.95	58.59	4.14
C2 C6	91.68	.62	6.15	.43	.43	.00	4.88	1.03	63.07	4.46
C3 C7	68.13	.53	5.25	.37	.31	.00	4.17	1.26	66.33	4.69
C4 T1	71.19	.50	5.04	.36	.35	.00	4.91	1.30	65.34	4.62
C5 T2	73.66	.50	5.01	.35	.39	.00	5.45	1.28	64.28	4.55
C6 T3	81.76	.49	4.93	.35	.44	.00	6.18	1.27	62.85	4.44
C7 T4	87.52	.49	4.92	.35	.46	.00	6.60	1.26	61.85	4.37
T1 T5	92.46	.51	5.09	.36	.48	.00	6.53	1.21	61.43	4.34
T2 T6	95.63	.54	5.37	.38	.46	.00	5.90	1.15	61.97	4.38
T3 T7	97.94	.55	5.57	.39	.43	.00	5.43	1.13	62.97	4.45
T4 T8	100.21	.57	5.71	.40	.41	.00	5.04	1.11	63.65	4.50
T5 T9	102.04	.57	5.68	.40	.41	.00	5.00	1.12	63.81	4.51
T6 T10	104.15	.58	5.83	.41	.41	.00	4.92	1.09	63.59	4.50
T7 T11	106.45	.58	5.80	.41	.45	.00	5.36	1.08	62.53	4.42
T8 T12	115.91	.60	5.95	.42	.50	.00	5.83	1.02	60.63	4.29
T9 L1	122.34	.61	6.14	.43	.54	.07	6.17	.96	58.68	4.15
T10 L2	128.49	.64	6.42	.45	.58	.07	6.36	.88	56.69	4.01
T11 L3	133.70	.67	6.72	.48	.61	.06	6.34	.82	55.33	3.91
T12 L4	137.14	.71	7.05	.50	.62	.06	6.16	.78	54.72	3.86
L1 L5	139.30	.74	7.30	.52	.57	.07	5.48	.79	57.35	4.06
C2 C7	106.21	.71	7.12	.50	.42	.00	4.13	.89	63.35	4.48
C3 T1	85.08	.61	6.13	.43	.34	.00	3.80	1.07	65.69	4.64
C4 T2	89.51	.59	5.80	.42	.39	.00	4.58	1.10	64.46	4.56
C5 T3	94.84	.58	5.82	.41	.43	.00	5.14	1.08	63.11	4.46
C6 T4	100.71	.58	5.79	.41	.45	.00	5.47	1.07	62.34	4.40
C7 T5	105.79	.59	5.94	.42	.47	.00	5.58	1.04	61.74	4.37
T1 T6	112.57	.62	6.28	.44	.47	.00	5.32	.99	61.58	4.36

Table 3
STATISTICAL ANALYSIS -- NEGRO MALES
(CONTINUED)

BONE-GROUP	MEAN	(+-)	SD	(+-)	CC	(+-)	RC	(+-)	SDE	(+-)
T2 T7	116.26	.65	6.48	.45	.45	.08	4.81	.96	62.51	4.42
T3 T8	118.99	.66	6.61	.47	.44	.08	4.60	.95	62.87	4.43
T4 T9	121.79	.66	6.63	.47	.42	.08	4.44	.96	63.37	4.48
T5 T10	125.62	.68	6.80	.48	.42	.08	4.36	.93	63.26	4.47
T6 T11	130.57	.70	7.00	.49	.44	.08	4.41	.90	62.67	4.43
T7 T12	136.55	.70	7.03	.50	.48	.08	4.75	.87	61.35	4.34
T8 L1	142.39	.71	7.13	.50	.53	.07	5.23	.83	59.07	4.13
T9 L2	150.67	.73	7.31	.52	.57	.07	5.48	.78	57.26	4.05
T10 L3	156.48	.78	7.80	.55	.60	.06	5.37	.72	55.89	3.95
T11 L4	161.55	.82	8.23	.58	.62	.06	5.24	.67	54.94	3.88
T12 L5	165.40	.86	8.58	.61	.58	.07	4.74	.66	56.83	4.02
C2 T1	123.16	.80	8.01	.57	.43	.08	3.75	.79	63.09	4.46
C3 T2	103.40	.69	6.93	.49	.37	.09	3.73	.94	64.88	4.59
C4 T3	108.29	.67	6.66	.47	.42	.08	4.41	.85	63.39	4.48
C5 T4	113.79	.67	6.66	.47	.45	.08	4.67	.94	62.53	4.42
C6 T5	120.18	.68	6.79	.48	.46	.08	4.73	.91	62.03	4.39
C7 T6	127.10	.70	7.03	.50	.47	.08	4.64	.89	61.78	4.37
T1 T7	133.20	.73	7.26	.51	.46	.08	4.41	.85	62.07	4.39
T2 T8	137.31	.75	7.50	.53	.45	.08	4.18	.80	62.42	4.41
T3 T9	140.57	.75	7.58	.53	.44	.08	4.12	.86	62.64	4.43
T4 T10	144.57	.77	7.74	.55	.43	.08	3.93	.81	62.91	4.45
T5 T11	150.03	.80	7.96	.56	.45	.08	3.95	.78	62.33	4.41
T6 T12	156.67	.82	8.20	.58	.47	.08	4.02	.75	61.60	4.36
T7 L1	164.62	.83	8.10	.59	.51	.07	4.32	.73	59.92	4.25
T8 L2	171.11	.83	8.37	.59	.55	.07	4.75	.70	57.73	4.09
T9 L3	178.89	.87	8.69	.61	.59	.07	4.73	.65	56.47	3.99
T10 L4	184.33	.90	9.08	.66	.61	.06	4.59	.68	55.37	3.92
T11 L5	188.82	.97	9.73	.69	.58	.07	4.19	.59	58.71	4.01
C2 T2	141.40	.80	8.82	.62	.44	.08	3.52	.71	62.57	4.42
C3 T3	122.18	.77	7.68	.54	.40	.08	3.67	.83	63.92	4.52
C4 T4	127.24	.75	7.47	.53	.44	.08	4.10	.84	62.79	4.44
C5 T5	133.25	.76	7.64	.54	.45	.08	4.15	.82	62.26	4.40
C6 T6	140.30	.79	7.86	.55	.46	.08	4.10	.79	61.88	4.38
C7 T7	147.73	.81	8.07	.57	.46	.08	3.96	.77	62.13	4.39
T1 T8	154.26	.83	8.26	.58	.45	.08	3.88	.75	62.50	4.38
T2 T9	159.66	.84	8.37	.59	.45	.08	3.88	.74	62.83	4.41
T3 T10	163.35	.86	8.60	.61	.45	.08	3.88	.72	62.97	4.42
T4 T11	168.98	.89	8.88	.63	.46	.08	3.90	.70	62.12	4.39
T5 T12	176.12	.91	9.15	.65	.48	.08	3.84	.67	61.41	4.34
T6 L1	184.14	.96	9.34	.66	.50	.07	3.78	.65	60.38	4.26
T7 L2	191.74	.96	9.32	.66	.54	.07	4.07	.63	58.64	4.14

Table 3

STATISTICAL ANALYSIS -- NEGRO MALES
(CONTINUED)

BONE-GROUP	MEAN	(+-)	SD	(+-)	CC	(+-)	RC	(+-)	SDE	(+-)
T8 L3	199.10	.96	9.64	.68	.58	.07	4.20	.59	56.93	4.03
T9 L4	205.91	1.02	10.16	.72	.60	.06	4.12	.55	56.90	3.95
T10 L5	212.60	1.08	10.77	.76	.58	.07	3.77	.53	56.85	4.02
C2 T3	160.26	.96	9.59	.68	.45	.08	3.39	.65	61.04	4.37
C3 T4	141.13	.85	8.48	.60	.42	.08	3.48	.75	63.33	4.48
C4 T5	145.79	.94	8.41	.59	.45	.08	3.72	.74	62.47	4.42
C5 T6	153.37	.87	8.70	.61	.45	.08	3.66	.71	62.16	4.40
C6 T7	160.92	.89	8.89	.63	.45	.08	3.57	.70	62.25	4.40
C7 T8	168.79	.90	9.05	.64	.45	.08	3.56	.69	62.03	4.39
T1 T9	175.83	.91	9.11	.64	.47	.08	3.57	.68	61.83	4.37
T2 T10	181.67	.94	9.45	.67	.46	.08	3.43	.66	61.90	4.38
T3 T11	187.76	.97	9.71	.69	.47	.08	3.40	.63	61.96	4.35
T4 T12	195.83	1.00	10.04	.71	.48	.08	3.35	.61	61.22	4.33
T5 L1	203.69	1.03	10.29	.73	.51	.07	3.48	.59	60.25	4.26
T6 L2	211.85	1.05	10.45	.74	.53	.07	3.56	.57	59.12	4.18
T7 L3	219.73	1.07	10.56	.75	.56	.07	3.68	.54	57.77	4.09
T8 L4	226.95	1.11	11.08	.78	.59	.06	3.73	.51	56.28	3.98
T9 L5	234.17	1.17	11.65	.82	.57	.07	3.45	.49	57.17	4.04
C2 T4	179.21	1.04	10.36	.73	.48	.08	3.21	.59	61.44	4.34
C3 T5	100.59	.94	9.39	.66	.43	.08	3.22	.67	62.96	4.45
C4 T6	166.82	.95	9.45	.67	.45	.08	3.34	.66	62.32	4.41
C5 T7	174.00	.97	9.71	.69	.45	.08	3.24	.64	62.37	4.41
C6 T8	181.98	.98	9.85	.70	.46	.08	3.25	.63	62.11	4.39
C7 T9	190.36	.99	9.89	.70	.46	.08	3.23	.63	61.85	4.37
T1 T10	198.61	1.02	10.19	.72	.47	.09	3.24	.60	61.55	4.35
T2 T11	206.08	1.05	10.55	.75	.48	.08	3.19	.58	61.23	4.33
T3 T12	213.86	1.09	10.86	.77	.49	.08	3.18	.56	60.74	4.29
T4 L1	222.55	1.12	11.18	.79	.51	.07	3.17	.54	60.16	4.25
T5 L2	231.33	1.14	11.41	.81	.53	.07	3.25	.52	59.19	4.19
T6 L3	239.05	1.18	11.78	.83	.55	.07	3.27	.49	58.26	4.12
T7 L4	247.59	1.21	12.08	.85	.58	.07	3.34	.47	57.04	4.03
T8 L5	255.22	1.26	12.55	.89	.57	.07	3.18	.46	57.34	4.05
C2 T5	190.67	1.13	11.25	.80	.48	.08	2.99	.54	61.21	4.33
C3 T6	180.71	1.04	10.41	.74	.44	.08	2.95	.60	62.25	4.41
C4 T7	187.45	1.05	10.46	.74	.45	.08	2.99	.60	62.30	4.40
C5 T8	195.06	1.07	10.67	.75	.45	.08	2.98	.58	62.03	4.37
C6 T9	203.55	1.07	10.68	.76	.45	.08	3.03	.58	61.93	4.38
C7 T10	213.14	1.18	10.55	.77	.47	.08	3.01	.56	61.57	4.35
T1 T11	223.02	1.13	11.37	.80	.49	.08	3.03	.54	60.92	4.31
T2 T12	232.17	1.17	11.69	.83	.50	.07	2.99	.52	60.48	4.28
T3 L1	241.32	1.20	12.08	.85	.52	.07	3.01	.50	59.76	4.23

Table 3

STATISTICAL ANALYSIS -- NEGRO MALES
(CONTINUED)

BONE-GROUP		MEAN	(+-)	SD	(+-)	CC	(+-)	RC	(+-)	SDE	(+-)
T4	L2	250.27	1.23	12.39	.87	.53	.07	3.02	.48	59.17	4.18
T5	L3	259.31	1.27	12.72	.90	.55	.07	3.02	.45	58.36	4.12
T6	L4	267.71	1.32	13.17	.93	.57	.07	3.01	.44	57.51	4.07
T7	L5	275.85	1.35	13.52	.96	.56	.07	2.89	.43	57.86	4.09
C2	T6	218.79	1.22	12.24	.87	.48	.08	2.76	.50	61.12	4.32
C3	T7	201.34	1.14	11.40	.81	.44	.08	2.68	.55	62.84	4.44
C4	T8	200.50	1.14	11.40	.81	.45	.08	2.77	.55	62.32	4.41
C5	T9	216.62	1.15	11.50	.81	.46	.08	2.79	.54	62.84	4.35
C6	T10	226.33	1.17	11.72	.83	.47	.08	2.80	.53	61.65	4.36
C7	T11	237.55	1.20	12.02	.85	.49	.08	2.84	.51	60.96	4.31
T1	T12	249.12	1.24	12.41	.88	.51	.07	2.85	.48	60.22	4.26
T2	L1	259.65	1.28	12.83	.91	.52	.07	2.84	.46	59.59	4.21
T3	L2	269.05	1.31	13.12	.93	.54	.07	2.87	.45	58.85	4.16
T4	L3	278.26	1.36	13.60	.96	.55	.07	2.82	.43	58.38	4.13
T5	L4	287.17	1.41	14.10	1.00	.57	.07	2.80	.41	57.62	4.07
T6	L5	295.97	1.46	14.61	1.03	.55	.07	2.65	.40	58.10	4.11
C2	T7	239.42	1.32	13.20	.93	.48	.08	2.54	.46	61.29	4.33
C3	T8	222.39	1.23	12.33	.87	.44	.08	2.51	.51	62.65	4.43
C4	T9	220.80	1.22	12.22	.86	.46	.08	2.61	.51	62.13	4.39
C5	T10	239.40	1.25	12.54	.89	.47	.08	2.60	.49	61.76	4.37
C6	T11	250.74	1.28	12.79	.90	.48	.08	2.65	.48	61.88	4.36
C7	T12	263.85	1.32	13.15	.93	.51	.07	2.68	.46	60.28	4.26
T1	L1	276.59	1.36	13.56	.96	.53	.07	2.71	.44	59.48	4.20
T2	L2	287.37	1.40	13.96	.99	.54	.07	2.71	.42	58.79	4.15
T3	L3	297.64	1.44	14.42	1.02	.55	.07	2.69	.40	58.11	4.11
T4	L4	306.12	1.50	14.95	1.06	.56	.07	2.64	.39	57.65	4.08
T5	L5	315.43	1.55	15.51	1.10	.55	.07	2.49	.38	58.21	4.12
C2	T8	260.47	1.41	14.09	1.00	.48	.08	2.39	.46	61.17	4.33
C3	T9	245.96	1.31	13.14	.93	.45	.08	2.38	.48	62.11	4.40
C4	T10	253.06	1.33	13.26	.94	.46	.08	2.45	.47	61.86	4.38
C5	T11	263.06	1.36	13.59	.96	.48	.08	2.48	.45	61.19	4.33
C6	T12	276.84	1.39	13.92	.98	.50	.07	2.52	.43	60.40	4.27
C7	L1	291.12	1.43	14.30	1.01	.52	.07	2.56	.42	59.58	4.21
T1	L2	304.32	1.47	14.69	1.04	.54	.07	2.59	.40	58.82	4.16
T2	L3	315.36	1.53	15.25	1.08	.56	.07	2.55	.38	58.09	4.10
T3	L4	324.98	1.58	15.76	1.11	.57	.07	2.53	.36	57.41	4.06
T4	L5	334.38	1.63	16.34	1.16	.55	.07	2.37	.36	58.17	4.11
C2	T9	282.94	1.49	14.87	1.05	.49	.08	2.38	.41	61.01	4.31
C3	T10	266.74	1.42	14.16	1.00	.46	.08	2.36	.44	61.71	4.36
C4	T11	277.27	1.43	14.31	1.01	.48	.08	2.44	.43	61.21	4.33
C5	T12	289.91	1.47	14.79	1.04	.50	.08	2.47	.41	60.75	4.29

Table 3

STATISTICAL ANALYSIS -- NEGRO MALES
(CONTINUED)

BONE-GROUP		MEAN	(+-)	SD	(+-)	CC	(+-)	RC	(+-)	SDE	(+-)
C6	L1	304.32	1.51	15.06	1.07	.52	.07	2.41	.40	59.66	4.22
C7	L2	318.85	1.54	15.43	1.09	.54	.07	2.45	.38	58.74	4.15
T1	L3	332.30	1.60	15.99	1.13	.56	.07	2.44	.36	57.97	4.10
T2	L4	343.22	1.66	16.58	1.17	.57	.07	2.40	.35	57.37	4.06
T3	L5	355.16	1.71	17.12	1.21	.58	.07	2.28	.34	57.90	4.09
C2	T10	304.83	1.59	15.07	1.12	.49	.08	2.17	.38	60.80	4.30
C3	T11	291.16	1.52	15.19	1.07	.47	.08	2.17	.41	61.61	4.36
C4	T12	303.36	1.54	15.42	1.09	.49	.08	2.24	.39	60.70	4.29
C5	L1	317.39	1.58	15.85	1.12	.52	.07	2.27	.38	59.84	4.23
C6	L2	332.04	1.62	16.18	1.14	.54	.07	2.32	.36	58.93	4.17
C7	L3	346.84	1.67	16.72	1.18	.56	.07	2.32	.35	58.12	4.11
T1	L4	360.16	1.73	17.32	1.22	.57	.07	2.31	.33	57.32	4.05
T2	L5	371.48	1.79	17.94	1.27	.58	.07	2.19	.32	57.82	4.09
C2	T11	329.24	1.69	16.90	1.19	.50	.07	2.08	.36	60.34	4.27
C3	T12	317.26	1.63	16.38	1.15	.49	.08	2.09	.37	61.02	4.31
C4	L1	330.94	1.66	16.57	1.17	.51	.07	2.16	.36	60.91	4.24
C5	L2	345.11	1.70	16.96	1.20	.53	.07	2.19	.35	59.13	4.18
C6	L3	360.03	1.75	17.48	1.24	.55	.07	2.20	.33	58.32	4.12
C7	L4	374.70	1.81	18.05	1.28	.57	.07	2.20	.32	57.49	4.06
T1	L5	388.42	1.87	18.67	1.32	.58	.07	2.10	.31	57.76	4.08
C2	T12	355.34	1.80	17.99	1.27	.52	.07	2.00	.33	59.83	4.23
C3	L1	344.73	1.74	17.44	1.23	.50	.07	2.02	.35	60.35	4.27
C4	L2	358.57	1.77	17.68	1.25	.53	.07	2.09	.34	59.33	4.20
C5	L3	373.19	1.83	18.26	1.29	.55	.07	2.09	.32	58.54	4.14
C6	L4	387.89	1.88	18.80	1.33	.56	.07	2.09	.31	57.69	4.08
C7	L5	402.96	1.94	19.40	1.37	.56	.07	2.01	.30	57.90	4.09
C2	L1	382.81	1.91	19.15	1.35	.53	.07	1.93	.31	59.06	4.19
C3	L2	372.46	1.85	18.54	1.31	.52	.07	1.96	.32	59.68	4.22
C4	L3	386.55	1.90	18.98	1.34	.54	.07	1.99	.31	58.75	4.15
C5	L4	401.96	1.96	19.57	1.38	.56	.07	2.00	.30	57.92	4.10
C6	L5	415.15	2.02	20.15	1.43	.56	.07	1.93	.29	58.07	4.11
C2	L3	410.53	2.03	20.37	1.43	.54	.07	1.87	.29	58.69	4.15
C3	L4	400.44	1.98	19.82	1.40	.53	.07	1.88	.30	59.18	4.18
C4	L5	413.41	2.03	20.29	1.43	.55	.07	1.91	.29	58.14	4.11
C5	L4	427.22	2.09	20.92	1.48	.56	.07	1.84	.28	58.26	4.12
C2	L5	438.52	2.15	21.56	1.52	.56	.07	1.79	.27	58.19	4.11
C3	L4	428.30	2.11	21.11	1.49	.55	.07	1.81	.28	58.48	4.14
C4	L5	442.67	2.16	21.63	1.53	.55	.07	1.77	.27	58.46	4.13
C2	L4	406.38	2.28	22.84	1.62	.56	.07	1.73	.25	57.65	4.08
C3	L3	456.56	2.35	23.46	1.59	.54	.07	1.68	.26	58.75	4.17
C2	L5	494.54	2.42	24.19	1.71	.56	.07	1.61	.24	57.97	4.10

Table 4

STATISTICAL ANALYSIS -- NEGRO FEMALES

THIS TABLE GIVES THE MEAN AND STANDARD DEVIATION (SD) FOR THE STATURE AND BONE-GROUP LENGTHS ALONG WITH THE CORRELATION COEFFICIENT (CC), REGRESSION COEFFICIENT (RC), AND THE STANDARD ERROR OF THE ESTIMATE (SDE) FOR EACH OF THE BONE-GROUPS. THE ESTIMATED ERRORS OF EACH OF THE ABOVE ARE ALSO PROVIDED. ALL MEASUREMENTS ARE IN MILLIMETERS.

STATURE: MEAN = 1630.06 (+-) 6.94 STANDARD DEVIATION = 69.41 (+-) 4.91

BONE-GROUP		MEAN	(+-)	SD	(+-)	CC	(+-)	RC	(+-)	SDE	(+-)
C2	C2	35.50	.21	2.09	.15	.52	.07	17.16	2.84	59.41	4.20
C3	C3	12.53	.09	.94	.07	.18	.10	12.97	7.27	68.33	4.93
C4	C4	12.23	.09	.89	.06	.26	.09	19.88	7.53	67.11	4.75
C5	C5	12.14	.09	.87	.06	.34	.09	27.37	7.46	65.17	4.61
C6	C6	12.39	.09	.87	.06	.33	.09	26.25	7.54	65.56	4.64
C7	C7	13.53	.08	.83	.06	.47	.08	39.59	7.39	61.18	4.33
T1	T1	15.62	.09	.92	.07	.54	.07	48.76	6.33	58.36	4.13
T2	T2	16.05	.08	.85	.05	.60	.06	49.18	6.55	55.50	3.92
T3	T3	17.33	.10	.96	.07	.47	.08	33.52	6.36	61.41	4.34
T4	T4	17.62	.10	1.01	.07	.44	.08	29.93	6.16	62.43	4.41
T5	T5	18.07	.10	.99	.07	.50	.07	35.24	6.08	60.06	4.25
T6	T6	18.66	.10	1.05	.07	.47	.08	31.31	5.85	61.19	4.33
T7	T7	19.13	.10	1.05	.07	.43	.08	28.36	6.08	62.75	4.44
T8	T8	19.60	.11	1.08	.08	.41	.08	26.40	5.88	63.32	4.48
T9	T9	20.19	.11	1.12	.08	.40	.08	24.97	5.65	63.48	4.49
T10	T10	21.33	.11	1.14	.08	.60	.06	36.20	4.88	55.75	3.94
T11	T11	22.78	.14	1.36	.10	.49	.08	24.83	4.47	60.09	4.29
T12	T12	24.51	.15	1.54	.11	.57	.07	25.82	3.70	56.91	4.02
L1	L1	25.99	.15	1.47	.10	.57	.07	26.88	3.87	57.03	4.03
L2	L2	26.83	.16	1.57	.11	.51	.07	22.60	3.79	59.61	4.22
L3	L3	27.40	.17	1.71	.12	.55	.07	22.44	3.40	57.91	4.09
L4	L4	27.38	.17	1.73	.12	.56	.07	22.31	3.33	57.69	4.08
L5	L5	27.49	.17	1.67	.12	.32	.09	13.35	3.93	65.77	4.65
C2	C3	48.03	.27	2.67	.19	.47	.08	12.14	2.30	61.37	4.31
C3	C4	24.76	.17	1.73	.12	.23	.09	9.13	3.91	67.60	4.78
C4	C5	24.37	.17	1.69	.12	.31	.09	12.78	3.89	65.95	4.66
C5	C6	24.53	.17	1.66	.12	.35	.09	14.85	3.92	64.91	4.59
C6	C7	25.92	.16	1.57	.11	.43	.08	19.11	3.99	62.61	4.43
C7	T1	29.15	.17	1.67	.12	.53	.07	22.14	3.52	58.73	4.15
T1	T2	32.48	.17	1.67	.12	.61	.06	25.20	3.32	55.26	3.91

Table 4

STATISTICAL ANALYSIS -- NEGRO FEMALES
(CONTINUED)

BONE-GROUP	MEAN	(+-)	SD	(+-)	CC	(+-)	RC	(+-)	SDE	(+-)
T2 T3	34.18	.17	1.69	.12	.57	.07	23.26	3.38	57.18	4.04
T3 T4	34.95	.19	1.90	.13	.47	.08	17.12	3.22	61.30	4.33
T4 T5	35.69	.19	1.91	.14	.49	.08	17.85	3.17	60.46	4.28
T5 T6	36.73	.19	1.95	.14	.51	.07	18.11	3.07	59.79	4.23
T6 T7	37.79	.20	2.02	.14	.47	.08	15.99	3.04	61.42	4.34
T7 T8	38.73	.20	2.05	.14	.43	.08	14.74	3.06	62.52	4.42
T8 T9	39.79	.21	2.12	.15	.42	.08	13.86	2.97	62.90	4.45
T9 T10	41.51	.21	2.12	.15	.54	.07	17.55	2.77	58.62	4.14
T10 T11	44.10	.24	2.40	.17	.56	.07	16.87	2.40	57.66	4.08
T11 T12	47.29	.28	2.81	.20	.55	.07	13.58	2.07	58.03	4.10
T12 L1	50.50	.29	2.93	.21	.59	.07	13.93	1.92	56.16	3.97
L1 L2	52.82	.28	2.95	.21	.56	.07	13.14	1.95	57.59	4.07
L2 L3	54.23	.31	3.14	.22	.56	.07	12.27	1.84	57.71	4.08
L3 L4	54.71	.33	3.29	.23	.58	.07	13.22	1.72	56.61	4.00
L4 L5	54.79	.32	3.20	.23	.47	.08	10.15	1.92	61.34	4.34
C2 C4	60.26	.33	3.30	.23	.45	.08	9.39	1.88	62.10	4.39
C3 C5	36.90	.25	2.48	.18	.28	.09	7.86	2.69	66.63	4.71
C4 C6	36.76	.24	2.45	.17	.33	.09	9.42	2.67	65.46	4.63
C5 C7	38.06	.23	2.30	.16	.43	.08	12.84	2.73	62.82	4.44
C6 T1	41.54	.24	2.35	.17	.50	.07	14.76	2.56	60.11	4.25
C7 T2	46.01	.24	2.37	.17	.59	.07	17.32	2.36	56.00	3.96
T1 T3	49.81	.24	2.44	.17	.60	.06	16.99	2.28	55.67	3.94
T2 T4	51.81	.26	2.58	.18	.54	.07	14.64	2.26	58.25	4.12
T3 T5	53.82	.28	2.79	.20	.50	.08	12.34	2.16	60.24	4.26
T4 T6	54.36	.28	2.84	.20	.50	.07	12.32	2.11	59.95	4.24
T5 T7	55.85	.29	2.88	.20	.50	.08	12.08	2.09	60.16	4.25
T6 T8	57.39	.30	3.01	.21	.46	.08	10.63	2.05	61.63	4.36
T7 T9	58.92	.31	3.06	.22	.44	.08	9.92	2.04	62.40	4.41
T8 T10	61.11	.31	3.07	.22	.51	.07	11.57	1.94	59.60	4.21
T9 T11	64.29	.33	3.32	.24	.54	.07	11.26	1.76	58.45	4.13
T10 T12	68.61	.38	3.83	.27	.50	.07	10.52	1.48	56.54	4.00
T11 L1	73.27	.41	4.15	.29	.57	.07	9.61	1.37	56.85	4.02
T12 L2	77.32	.43	4.33	.31	.58	.07	9.34	1.30	56.40	3.99
L1 L3	80.32	.45	4.47	.32	.58	.07	8.99	1.27	56.61	4.00
L2 L4	81.53	.46	4.64	.33	.58	.07	8.75	1.21	56.33	3.98
L3 L5	82.20	.47	4.67	.33	.52	.07	7.79	1.27	59.22	4.19
C2 C5	72.40	.39	3.95	.28	.45	.08	7.92	1.57	61.98	4.38
C3 C6	40.29	.32	3.21	.23	.31	.09	6.61	2.06	66.10	4.67
C4 C7	50.29	.31	3.06	.22	.39	.08	8.92	2.08	63.81	4.51
C5 T1	53.68	.30	3.05	.21	.40	.08	11.15	2.08	60.62	4.29
C6 T2	56.48	.30	3.02	.21	.56	.07	12.81	1.91	57.61	4.07

Table 4
STATISTICAL ANALYSIS -- NEGRO FEMALES
(CONTINUED)

BONE-GROUP	MEAN	(+-)	SD	(+-)	CC	(+-)	RC	(+-)	SDE	(+-)
C7 T3	63.33	.31	3.10	.22	.60	.06	13.35	1.80	55.72	3.94
T1 T4	67.48	.33	3.29	.23	.59	.07	12.23	1.72	56.61	4.00
T3 T5	69.87	.35	3.45	.24	.55	.07	10.90	1.68	58.07	4.11
T5 T6	71.68	.37	3.72	.26	.51	.07	9.44	1.61	59.87	4.23
T4 T7	73.49	.37	3.73	.26	.50	.07	9.36	1.61	59.97	4.24
T5 T8	75.46	.38	3.84	.27	.49	.08	8.85	1.58	60.53	4.28
T6 T9	77.58	.40	4.00	.28	.46	.08	7.98	1.54	61.65	4.36
T7 T10	80.24	.40	4.00	.28	.51	.07	8.78	1.50	59.88	4.23
T8 T11	83.88	.42	4.21	.30	.53	.07	8.74	1.40	58.85	4.16
T9 T12	88.88	.47	4.70	.33	.57	.07	8.39	1.21	57.11	4.04
T10 L1	94.60	.51	5.14	.36	.60	.06	8.04	1.09	55.77	3.94
T11 L2	100.10	.55	5.51	.39	.58	.07	7.28	1.03	56.65	4.01
T12 L3	104.73	.58	5.79	.41	.60	.06	7.17	.96	55.60	3.93
L1 L4	107.52	.59	5.91	.42	.60	.06	7.06	.94	55.44	3.92
L2 L5	109.02	.60	5.97	.42	.54	.07	6.32	.98	58.26	4.12
C2 C6	84.79	.46	4.62	.33	.45	.08	6.69	1.34	62.13	4.39
C3 C7	62.82	.38	3.79	.27	.36	.09	6.63	1.71	64.71	4.58
C4 T1	65.91	.38	3.75	.27	.45	.08	8.40	1.65	61.83	4.37
C5 T2	70.54	.37	3.68	.26	.54	.07	10.17	1.59	58.45	4.13
C6 T3	75.73	.37	3.71	.26	.58	.07	10.77	1.53	56.75	4.01
C7 T4	80.96	.38	3.92	.28	.58	.07	10.36	1.44	56.30	3.98
T1 T5	85.50	.42	4.15	.29	.58	.07	9.64	1.37	56.68	4.01
T2 T6	88.54	.44	4.38	.31	.55	.07	8.66	1.33	58.15	4.11
T3 T7	90.82	.45	4.59	.32	.51	.07	7.66	1.30	59.83	4.23
T4 T8	93.09	.46	4.56	.33	.50	.08	7.46	1.29	60.14	4.25
T5 T9	95.65	.48	4.81	.34	.48	.08	6.99	1.26	60.72	4.29
T6 T10	98.38	.49	4.93	.35	.51	.07	7.20	1.21	59.66	4.22
T7 T11	103.02	.51	5.09	.36	.53	.07	7.20	1.16	58.98	4.17
T8 T12	108.48	.55	5.54	.39	.56	.07	7.05	1.04	57.39	4.06
T9 L1	114.79	.60	5.99	.42	.59	.07	6.80	.94	56.20	3.97
T10 L2	121.43	.65	6.48	.46	.60	.06	6.39	.86	55.71	3.94
T11 L3	127.51	.69	6.92	.49	.60	.06	5.96	.80	56.78	3.99
T12 L4	132.03	.72	7.16	.51	.62	.06	5.99	.78	54.55	3.86
L1 L5	135.01	.72	7.19	.51	.57	.07	5.48	.79	57.13	4.04
C2 C7	58.32	.52	5.29	.37	.47	.08	6.31	1.19	61.19	4.33
C3 T1	70.45	.48	4.45	.31	.42	.08	6.56	1.42	62.83	4.45
C4 T2	82.77	.44	4.37	.31	.51	.07	8.84	1.37	59.86	4.23
C5 T3	87.87	.43	4.35	.31	.56	.07	8.94	1.32	57.43	4.07
C6 T4	93.35	.45	4.49	.32	.57	.07	8.86	1.26	56.86	4.02
C7 T5	98.43	.48	4.77	.34	.58	.07	8.51	1.18	56.32	3.98
T1 T6	103.16	.51	5.06	.36	.57	.07	7.83	1.13	56.98	4.03

Table 4

STATISTICAL ANALYSIS -- NEGRO FEMALES
(CONTINUED)

BONE-GROUP		MEAN	(+-)	SD	(+-)	CC	(+-)	RC	(+-)	SDE	(+-)
T2	T7	107.67	.52	5.25	.37	.54	.07	7.15	1.11	58.38	4.13
T3	T8	110.41	.55	5.48	.39	.51	.07	6.40	1.09	59.90	4.24
T4	T9	113.27	.56	5.59	.40	.50	.08	6.16	1.08	60.27	4.26
T5	T10	116.98	.57	5.74	.41	.52	.07	6.35	1.03	59.98	4.18
T6	T11	121.68	.60	5.99	.42	.53	.07	6.15	.90	58.84	4.16
T7	T12	127.53	.64	6.36	.45	.56	.07	6.11	.90	57.51	4.07
T8	L1	134.39	.68	6.79	.48	.58	.07	5.95	.83	56.43	3.99
T9	L2	141.61	.73	7.31	.52	.59	.07	5.62	.77	55.99	3.96
T10	L3	148.83	.79	7.89	.56	.61	.06	5.36	.70	55.04	3.89
T11	L4	154.30	.83	8.26	.58	.62	.06	5.18	.66	54.68	3.87
T12	L5	159.52	.84	8.39	.59	.59	.06	4.89	.67	55.96	3.96
C2	T1	113.95	.58	5.85	.41	.50	.07	6.00	1.02	59.91	4.24
C3	T2	95.30	.50	5.04	.36	.47	.08	6.50	1.21	61.20	4.33
C4	T3	100.10	.50	5.02	.35	.53	.07	7.35	1.17	58.81	4.16
C5	T4	105.49	.61	5.11	.35	.56	.07	7.65	1.12	57.36	4.06
C6	T5	111.42	.53	5.33	.38	.58	.07	7.52	1.06	56.69	4.01
C7	T6	117.69	.57	5.67	.40	.58	.07	7.09	1.03	56.59	4.00
T1	T7	123.29	.59	5.93	.42	.56	.07	6.60	.97	57.35	4.06
T2	T8	127.26	.61	6.13	.43	.54	.07	6.06	.96	58.63	4.15
T3	T9	130.60	.64	6.40	.45	.50	.07	5.46	.94	59.97	4.24
T4	T10	134.60	.65	6.50	.45	.53	.07	5.67	.90	58.80	4.16
T5	T11	139.75	.68	6.70	.48	.54	.07	5.54	.86	58.37	4.13
T6	T12	146.19	.72	7.24	.51	.56	.07	5.38	.79	57.48	4.06
T7	L1	153.52	.76	7.58	.54	.58	.07	5.31	.75	56.56	4.00
T8	L2	161.21	.81	8.09	.57	.59	.07	5.05	.69	56.13	3.97
T9	L3	169.02	.87	8.69	.61	.61	.06	4.83	.64	55.25	3.91
T10	L4	176.13	.92	9.19	.65	.63	.06	4.74	.59	54.03	3.82
T11	L5	182.30	.95	9.45	.67	.59	.06	4.37	.59	55.80	3.95
C2	T2	130.80	.64	6.44	.46	.54	.07	5.80	.91	58.52	4.14
C3	T3	112.62	.57	5.67	.40	.50	.08	6.11	1.06	60.16	4.25
C4	T4	117.72	.58	5.76	.41	.54	.07	6.51	1.02	58.44	4.13
C5	T5	123.56	.59	5.90	.42	.57	.07	6.67	.96	57.05	4.03
C6	T6	130.00	.62	6.20	.44	.58	.07	6.41	.92	56.79	4.02
C7	T7	136.83	.65	6.52	.46	.57	.07	6.08	.87	56.45	4.00
T1	T8	142.89	.68	6.80	.48	.56	.07	5.80	.83	57.70	4.08
T2	T9	147.45	.70	7.04	.50	.53	.07	5.22	.84	58.86	4.16
T3	T10	151.92	.73	7.29	.52	.54	.07	5.10	.80	58.61	4.14
T4	T11	157.37	.75	7.53	.53	.55	.07	5.03	.77	58.15	4.11
T5	T12	164.26	.80	8.02	.57	.57	.07	4.91	.71	57.16	4.04
T6	L1	172.10	.84	8.44	.60	.58	.07	4.77	.67	56.53	4.00
T7	L2	180.35	.89	8.86	.63	.59	.07	4.60	.63	56.17	3.97

Table 4

STATISTICAL ANALYSIS -- NEGRO FEMALES
(CONTINUED)

BONE-GROUP	MEAN	(+-)	SD	(+-)	CC	(+-)	RC	(+-)	SDE	(+-)
T8 L3	188.61	.95	9.46	.67	.60	.06	4.42	.59	55.39	3.92
T9 L4	196.32	1.00	9.98	.71	.62	.06	4.34	.54	54.27	3.84
T10 L5	203.62	1.04	10.36	.73	.61	.06	4.07	.53	55.09	3.90
C2 T3	148.12	.71	7.05	.50	.55	.07	5.45	.82	57.77	4.08
C3 T4	130.25	.64	6.39	.45	.51	.07	5.56	.93	59.62	4.22
C4 T5	135.79	.65	6.54	.46	.55	.07	5.84	.89	57.96	4.10
C5 T6	142.22	.68	6.78	.48	.57	.07	5.84	.84	57.82	4.08
C6 T7	149.21	.70	7.04	.50	.57	.07	5.82	.81	57.82	4.09
C7 T8	156.42	.74	7.39	.52	.56	.07	5.38	.78	57.38	4.05
T1 T9	163.08	.77	7.71	.55	.55	.07	4.84	.75	58.02	4.10
T2 T10	168.78	.79	7.94	.56	.56	.07	4.86	.73	57.69	4.08
T3 T11	174.70	.83	8.30	.59	.55	.07	4.60	.70	57.97	4.10
T4 T12	181.89	.89	8.75	.62	.57	.07	4.52	.65	57.81	4.08
T5 L1	190.25	.92	9.30	.65	.59	.07	4.42	.61	56.26	3.98
T6 L2	199.01	.97	9.69	.69	.59	.07	4.21	.58	56.13	3.97
T7 L3	207.75	1.02	10.21	.72	.60	.06	4.09	.54	55.43	3.92
T8 L4	215.92	1.07	10.73	.76	.62	.06	4.01	.51	54.42	3.85
T9 L5	223.81	1.11	11.15	.79	.61	.06	3.78	.50	55.20	3.90
C2 T4	155.75	.77	7.74	.55	.56	.07	5.04	.74	57.48	4.06
C3 T5	148.32	.72	7.15	.51	.53	.07	5.10	.82	59.02	4.17
C4 T6	154.45	.74	7.38	.52	.55	.07	5.22	.78	57.74	4.08
C5 T7	161.36	.76	7.61	.54	.57	.07	5.18	.75	57.16	4.04
C6 T8	168.81	.79	7.89	.56	.56	.07	4.96	.73	57.30	4.05
C7 T9	176.61	.83	8.30	.59	.56	.07	4.66	.69	57.63	4.08
T1 T10	184.49	.86	8.61	.61	.57	.07	4.60	.66	57.01	4.03
T2 T11	191.55	.89	8.94	.63	.57	.07	4.41	.64	57.14	4.04
T3 T12	199.21	.95	9.50	.67	.57	.07	4.19	.60	56.88	4.02
T4 L1	207.07	.99	9.92	.70	.59	.07	4.12	.57	56.13	3.97
T5 L2	217.68	1.04	10.44	.74	.59	.06	3.94	.54	55.87	3.95
T6 L3	226.41	1.10	11.02	.78	.60	.06	3.80	.50	55.39	3.92
T7 L4	235.05	1.15	11.48	.81	.62	.06	3.74	.47	54.58	3.85
T8 L5	243.48	1.19	11.90	.84	.61	.06	3.53	.46	55.27	3.91
C2 T5	183.83	.85	8.49	.60	.57	.07	4.67	.67	56.99	4.03
C3 T6	186.98	.80	7.97	.56	.53	.07	4.65	.74	58.67	4.15
C4 T7	173.58	.82	8.19	.58	.55	.07	4.70	.71	57.74	4.08
C5 T8	180.36	.84	8.45	.60	.56	.07	4.63	.68	57.35	4.06
C6 T9	189.00	.88	8.79	.62	.56	.07	4.41	.65	57.58	4.07
C7 T10	197.93	.92	9.19	.65	.58	.07	4.36	.62	56.69	4.01
T1 T11	207.18	.96	9.60	.68	.58	.07	4.19	.59	56.54	4.00
T2 T12	216.07	1.01	10.13	.72	.59	.07	4.03	.55	56.16	3.97
T3 L1	225.49	1.06	10.64	.75	.59	.07	3.85	.53	56.02	3.96

Table 4

STATISTICAL ANALYSIS -- NEGRO FEMALES
(CONTINUED)

BONE-GROUP	MEAN	(+-)	SD	(+-)	CC	(+-)	RC	(+-)	SDE	(+-)
T4 L2	234.70	1.11	11.14	.79	.60	.06	3.71	.50	55.74	3.94
T5 L3	244.48	1.18	11.76	.83	.61	.06	3.58	.47	56.17	3.90
T6 L4	253.71	1.23	12.27	.87	.62	.06	3.51	.44	54.47	3.85
T7 L5	262.54	1.26	12.60	.89	.60	.06	3.32	.44	56.29	3.91
C2 T6	202.48	.93	9.28	.66	.58	.07	4.31	.61	56.76	4.01
C3 T7	196.11	.88	8.77	.62	.54	.07	4.25	.67	58.55	4.14
C4 T8	193.10	.90	9.01	.64	.55	.07	4.28	.64	57.82	4.09
C5 T9	201.14	.93	9.33	.66	.56	.07	4.16	.62	57.57	4.07
C6 T10	210.33	.97	9.68	.68	.58	.07	4.14	.59	56.68	4.01
C7 T11	220.71	1.02	10.18	.72	.59	.07	3.99	.56	56.26	3.98
T1 T12	231.69	1.08	10.80	.76	.60	.06	3.84	.52	56.66	3.94
T2 L1	242.85	1.13	11.27	.80	.60	.06	3.71	.49	56.39	3.92
T3 L2	252.62	1.19	11.86	.84	.60	.06	3.58	.47	56.64	3.93
T4 L3	262.10	1.25	12.45	.88	.61	.06	3.39	.44	56.97	3.80
T5 L4	271.78	1.30	13.00	.92	.62	.06	3.32	.42	54.30	3.84
T6 L5	281.28	1.34	13.42	.95	.61	.06	3.14	.41	56.19	3.90
C2 T7	221.61	1.00	10.05	.71	.58	.07	3.98	.56	56.72	4.01
C3 T8	205.71	.96	9.57	.68	.54	.07	3.90	.61	58.51	4.14
C4 T9	213.37	.99	9.87	.70	.55	.07	3.87	.59	57.96	4.10
C5 T10	222.46	1.02	10.21	.72	.58	.07	3.98	.56	56.68	4.01
C6 T11	233.10	1.07	10.66	.75	.59	.07	3.82	.53	56.22	3.98
C7 T12	245.22	1.14	11.37	.80	.60	.06	3.67	.49	56.44	3.92
T1 L1	257.68	1.19	11.94	.84	.61	.06	3.55	.46	54.96	3.83
T2 L2	268.88	1.25	12.48	.88	.61	.06	3.39	.44	56.87	3.80
T3 L3	279.43	1.32	13.16	.93	.61	.06	3.22	.42	54.98	3.88
T4 L4	289.41	1.37	13.69	.97	.62	.06	3.17	.40	54.23	3.83
T5 L5	299.27	1.42	14.16	1.00	.61	.06	2.99	.39	56.00	3.89
C2 T8	241.21	1.08	10.81	.76	.58	.07	3.78	.52	56.72	4.01
C3 T9	225.90	1.04	10.41	.74	.54	.07	3.59	.56	58.51	4.14
C4 T10	234.70	1.07	10.74	.76	.57	.07	3.68	.53	57.05	4.03
C5 T11	245.24	1.12	11.16	.79	.59	.07	3.65	.50	56.20	3.97
C6 T12	257.61	1.18	11.84	.84	.60	.06	3.53	.47	56.42	3.92
C7 L1	271.21	1.25	12.52	.88	.61	.06	3.40	.44	54.79	3.87
T1 L2	284.51	1.31	13.15	.93	.62	.06	3.25	.42	54.68	3.84
T2 L3	296.28	1.38	13.78	.97	.62	.06	3.12	.40	54.47	3.85
T3 L4	306.73	1.44	14.39	1.02	.63	.06	3.02	.38	54.18	3.83
T4 L5	316.90	1.48	14.83	1.05	.61	.06	2.86	.37	54.89	3.88
C2 T9	261.48	1.16	11.61	.82	.58	.07	3.44	.49	56.76	4.01
C3 T10	247.23	1.13	11.27	.80	.56	.07	3.48	.51	57.82	4.09
C4 T11	257.47	1.17	11.68	.83	.58	.07	3.45	.48	56.53	4.00
C5 T12	269.75	1.23	12.32	.87	.60	.06	3.39	.46	55.91	3.92

Table 4

STATISTICAL ANALYSIS -- NEGRO FEMALES
(CONTINUED)

BONE-GROUP	MEAN	(+-)	SD	(+-)	CC	(+-)	RC	(+-)	SDE	(+-)
C6 L1	253.60	1.30	12.99	.92	.61	.06	3.28	.42	54.81	3.88
C7 L2	293.03	1.37	13.72	.97	.62	.06	3.13	.40	54.53	3.66
T1 L3	311.91	1.44	14.44	1.02	.63	.06	3.01	.37	54.13	3.83
T2 L4	323.59	1.50	15.01	1.06	.63	.06	2.93	.36	53.73	3.80
T3 L5	334.22	1.55	15.53	1.10	.61	.06	2.74	.35	54.82	3.88
C2 T10	282.72	1.25	12.46	.88	.59	.07	3.29	.45	55.98	3.96
C3 T11	270.00	1.22	12.19	.85	.57	.07	3.24	.47	57.06	4.03
C4 T12	281.98	1.28	12.84	.91	.60	.06	3.22	.43	55.72	3.94
C5 L1	295.74	1.35	13.48	.95	.61	.06	3.16	.41	54.82	3.88
C6 L2	310.42	1.42	14.20	1.00	.62	.06	3.02	.38	54.56	3.86
C7 L3	325.44	1.50	15.01	1.06	.63	.06	2.90	.36	54.01	3.82
T1 L4	339.21	1.57	15.66	1.11	.64	.06	2.83	.34	53.42	3.78
T2 L5	351.63	1.61	16.15	1.14	.62	.06	2.67	.34	54.37	3.84
C2 T11	305.50	1.34	13.37	.95	.60	.06	3.12	.42	55.53	3.95
C3 T12	294.51	1.33	13.34	.94	.59	.07	3.05	.42	56.22	3.98
C4 L1	307.97	1.40	13.99	.99	.61	.06	3.01	.39	55.15	3.90
C5 L2	322.57	1.47	14.69	1.04	.62	.06	2.92	.37	54.58	3.86
C6 L3	337.83	1.55	15.49	1.10	.63	.06	2.81	.35	54.07	3.82
C7 L4	352.74	1.62	16.23	1.15	.64	.06	2.74	.33	53.31	3.77
T1 L5	366.70	1.68	16.79	1.19	.63	.06	2.59	.32	54.05	3.82
C2 T12	330.01	1.45	14.51	1.03	.61	.06	2.94	.38	54.80	3.87
C3 L1	320.50	1.45	14.49	1.02	.60	.06	2.86	.38	55.64	3.93
C4 L2	334.79	1.52	15.20	1.07	.61	.06	2.79	.36	54.90	3.88
C5 L3	349.97	1.60	15.99	1.13	.63	.06	2.72	.34	54.11	3.83
C6 L4	365.13	1.67	16.70	1.18	.64	.06	2.66	.32	53.37	3.77
C7 L5	380.23	1.73	17.35	1.23	.63	.06	2.52	.31	53.91	3.81
C2 L1	356.00	1.57	15.65	1.11	.62	.06	2.76	.35	54.32	3.84
C3 L2	347.33	1.57	15.69	1.11	.60	.06	2.67	.35	55.36	3.91
C4 L3	362.20	1.65	16.50	1.17	.62	.06	2.61	.33	54.42	3.85
C5 L4	377.27	1.72	17.20	1.22	.64	.06	2.58	.31	53.42	3.78
C6 L5	392.62	1.78	17.81	1.26	.63	.06	2.45	.30	53.92	3.81
C2 L2	382.83	1.69	16.85	1.19	.63	.06	2.58	.32	54.12	3.83
C3 L3	374.73	1.70	17.00	1.20	.61	.06	2.50	.32	54.87	3.88
C4 L4	390.56	1.77	17.76	1.25	.63	.06	2.48	.30	53.73	3.80
C5 L5	404.76	1.83	18.29	1.29	.63	.06	2.39	.29	53.93	3.81
C2 L3	410.23	1.82	18.15	1.28	.62	.06	2.42	.30	53.73	3.80
C3 L4	402.03	1.82	18.19	1.29	.63	.06	2.39	.30	54.18	3.83
C4 L5	416.99	1.88	18.78	1.33	.63	.06	2.31	.29	54.18	3.83
C2 L4	437.53	1.93	19.33	1.37	.64	.06	2.31	.27	53.09	3.75
C3 L5	429.52	1.93	19.27	1.36	.62	.06	2.23	.28	54.03	3.82
C2 L5	465.92	2.04	20.38	1.44	.64	.06	2.17	.26	53.58	3.78

mean was significantly different, although just barely.*

The coefficients of correlation for single vertebrae varied from a low of .18** to a high of .60 for the females. The males were less extreme in their variation with a low of .24 and a high of .58. The highest bone-group correlation was .62 for the males (in 5 different bone-groups) and .64 for the females (in 6 different bone-groups).

For the females, the coefficients of correlation continued to improve as the number of vertebrae in the bone-groups increased; the highest correlations appearing in groups containing 16, 17, 18, 19, 22, and 23 vertebrae. In contrast, while the males generally improved with greater numbers of vertebrae, the highest correlations were in groups of 3, 4, 5, and 6 vertebrae and none of the bone-groups with 11 or more vertebrae had correlations as high as the single vertebrae L1 and L2.

The errors involved in stature estimations based on the bone-groups follow the same general pattern as the coefficients of correlation. The estimation equation for bone-group T12-L4 has the smallest standard error (54.72mm) for the males. Bone-group C2-L4 has the smallest standard error (53.09mm) for the females. Figures 5 and 6 show the regression lines (plus or minus one standard error) of the T12-L4 bone-group for the males and of the C2-L4 bone-group for the females, respectively.

Additional scattergrams showing the regression lines for bone-groups with the second and third lowest standard errors for each sex and scattergrams with the regression lines for the entire vertebral column (C2-L5) for each sex are included as figures 7 through 12 at the end of this section.

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*The mean was not significantly different at $P<.045$.

**This coefficient of correlation is not significantly different from a correlation of zero. All other coefficients of correlation found in this study differ significantly from zero.

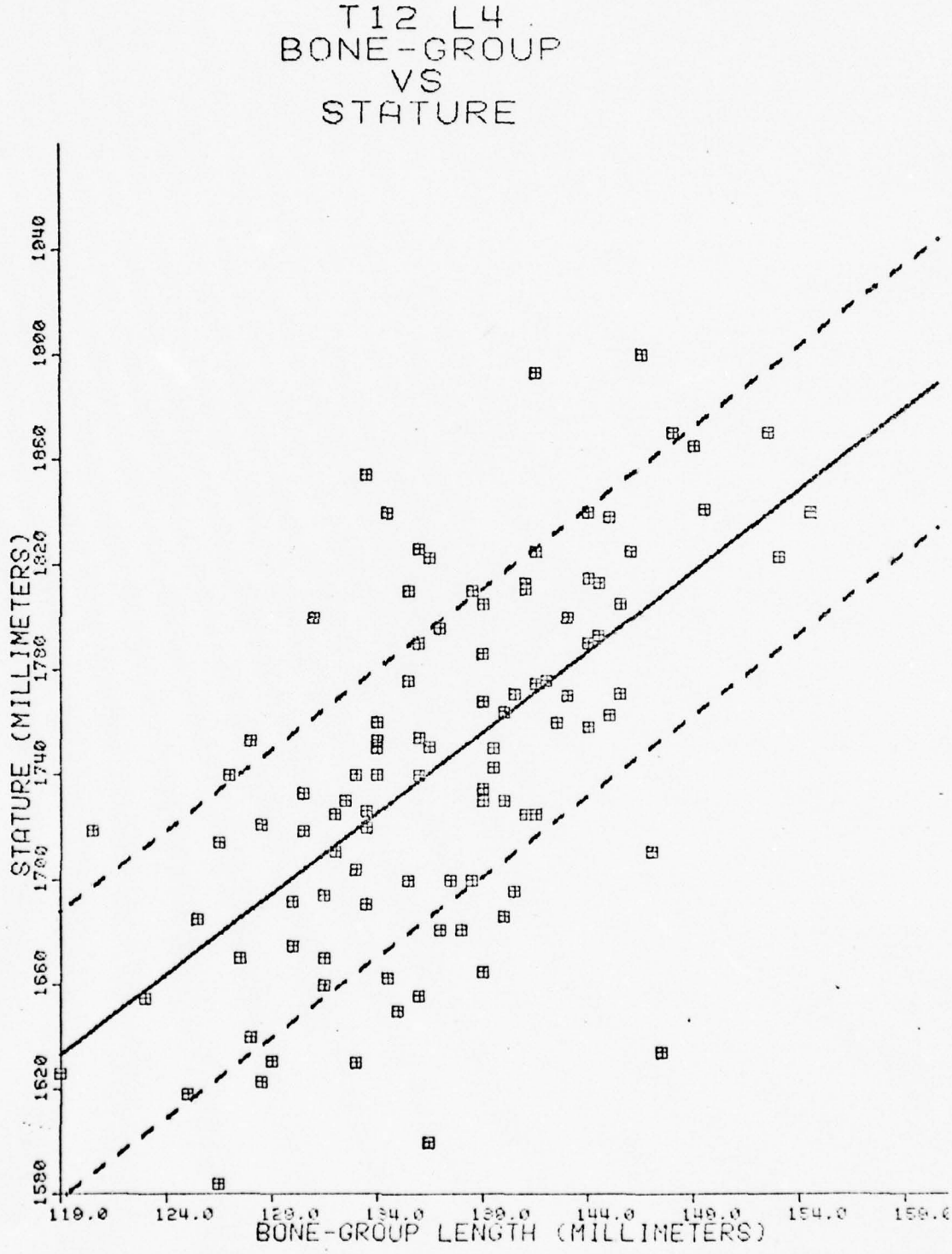

Fig. 5 Scattergram of Negro male data, bone-group T12-L4

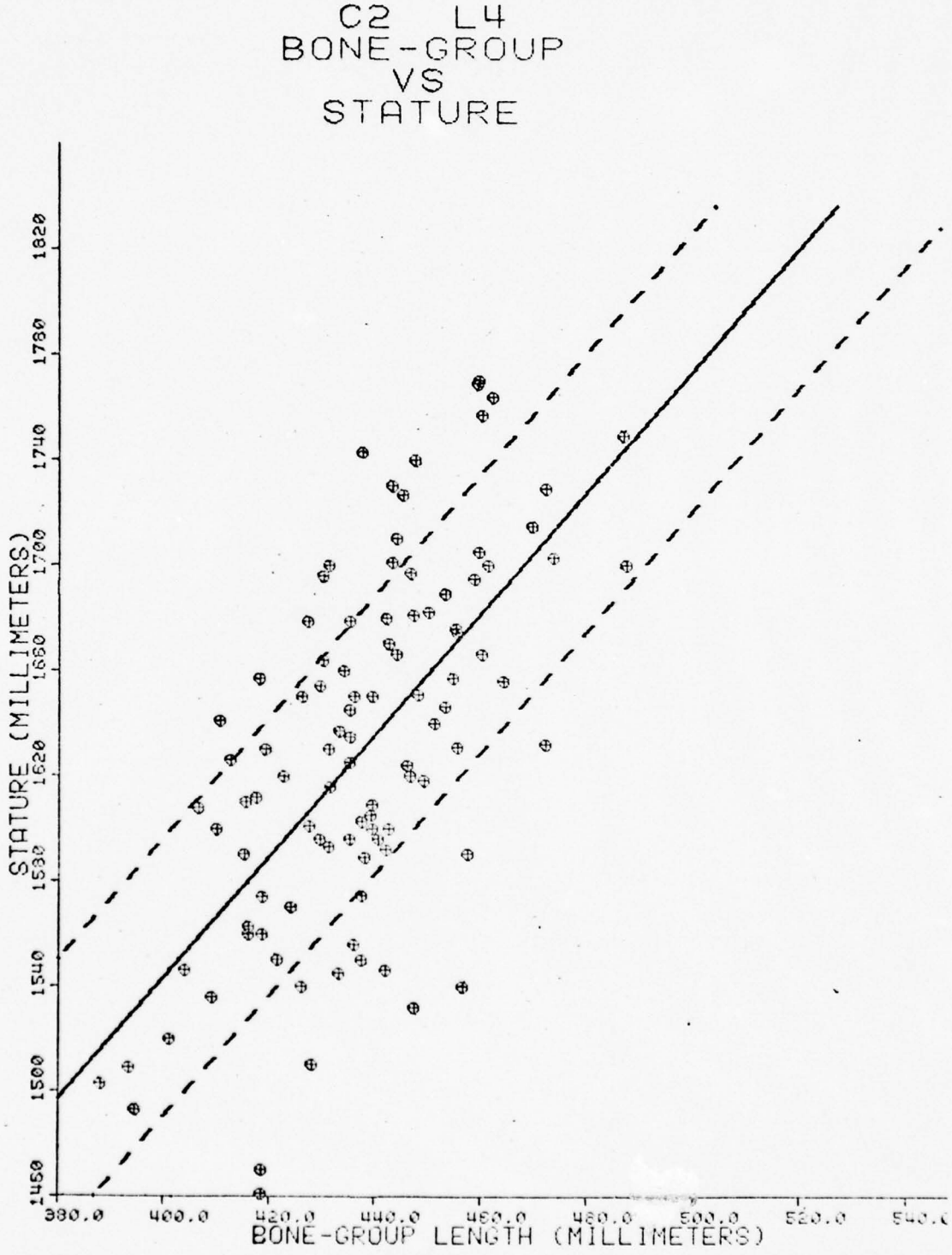

Fig. 6 Scattergram of Negro female data, bone-group C2-L4

The standard errors of the estimation equations range from the lows given above to highs of 67.89mm for the males and 68.33mm for the females. The standard deviation of stature does not differ significantly from the standard errors of the estimation equations in 172 bone-groups for the males and 60 bone-groups for the females.* Of the remaining estimation equations, none of their standard errors differ significantly from the least of the standard errors.

The regression formulae for the estimation of cadaver stature (with standard errors) are given in tables 5 and 6. For the equivalent of living stature, 25mm should be subtracted from the cadaver stature. For estimating stature of individuals over 30 years of age, .6mm should be subtracted from the estimated stature for each year of age over 30 years.

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*The standard error must be less than 60.17mm for the males and 59.79mm for the females to be significantly different from the standard deviation of the stature.

Table 5

REGRESSION FORMULAE FOR NEGRO MALES
(DIMENSIONS IN MILLIMETERS)

STATURE	=	1200.12	+14.30	X	(C2	C2)	(+-)	59.40
	=	1566.93	+12.80	X	(C3	C3)	(+-)	67.69
	=	1508.52	+17.56	X	(C4	C4)	(+-)	67.14
	=	1494.88	+19.11	X	(C5	C5)	(+-)	66.52
	=	1504.59	+19.20	X	(C6	C6)	(+-)	66.64
	=	1479.56	+19.25	X	(C7	C7)	(+-)	66.53
	=	1396.22	+20.57	X	(T1	T1)	(+-)	65.19
	=	1306.48	+23.92	X	(T2	T2)	(+-)	63.81
	=	1163.24	+30.96	X	(T3	T3)	(+-)	61.08
	=	1255.93	+25.79	X	(T4	T4)	(+-)	63.41
	=	1375.60	+18.92	X	(T5	T5)	(+-)	65.04
	=	1359.01	+19.17	X	(T6	T6)	(+-)	64.82
	=	1384.45	+17.46	X	(T7	T7)	(+-)	66.23
	=	1296.40	+21.34	X	(T8	T8)	(+-)	64.61
	=	1253.61	+22.76	X	(T9	T9)	(+-)	64.69
	=	1266.32	+21.00	X	(T10	T10)	(+-)	63.84
	=	1154.84	+23.75	X	(T11	T11)	(+-)	61.82
	=	1069.86	+25.12	X	(T12	T12)	(+-)	59.32
	=	971.04	+20.16	X	(L1	L1)	(+-)	56.68
	=	972.97	+27.04	X	(L2	L2)	(+-)	56.74
	=	1084.59	+23.59	X	(L3	L3)	(+-)	57.85
	=	1152.28	+21.26	X	(L4	L4)	(+-)	58.54
	=	1428.67	+11.18	X	(L5	L5)	(+-)	66.40
	=	1244.01	+ 9.63	X	(C2	C3)	(+-)	61.36
	=	1518.85	+ 8.23	X	(C3	C4)	(+-)	67.30
	=	1479.10	+10.01	X	(C4	C5)	(+-)	66.56
	=	1473.16	+10.15	X	(C5	C6)	(+-)	66.29
	=	1472.64	+ 9.81	X	(C6	C7)	(+-)	66.33
	=	1392.96	+11.10	X	(C7	T1)	(+-)	65.26
	=	1306.08	+13.01	X	(T1	T2)	(+-)	63.58
	=	1186.05	+15.96	X	(T2	T3)	(+-)	61.74
	=	1163.25	+15.41	X	(T3	T4)	(+-)	61.60
	=	1271.59	+14.32	X	(T4	T5)	(+-)	63.61
	=	1311.71	+10.94	X	(T5	T6)	(+-)	64.16
	=	1348.79	+ 9.84	X	(T6	T7)	(+-)	65.12
	=	1317.14	+10.26	X	(T7	T8)	(+-)	65.20
	=	1253.61	+11.90	X	(T8	T9)	(+-)	64.17
	=	1205.43	+12.16	X	(T9	T10)	(+-)	63.41
	=	1168.49	+12.38	X	(T10	T11)	(+-)	61.43
	=	1083.69	+13.99	X	(T11	T12)	(+-)	59.53
	=	968.37	+14.31	X	(T12	L1)	(+-)	57.08
	=	934.21	+15.22	X	(L1	L2)	(+-)	55.41
	=	921.96	+13.82	X	(L2	L3)	(+-)	55.13
	=	1053.41	+12.27	X	(L3	L4)	(+-)	56.56
	=	1254.16	+ 8.74	X	(L4	L5)	(+-)	62.87
	=	1235.48	+ 7.43	X	(C2	C4)	(+-)	62.15

STATURE	=	1491.38	+ 5.27	X	(C3	C5)	(+-)	66.82
	=	1464.93	+ 7.84	X	(C4	C6)	(+-)	66.28
	=	1458.90	+ 7.81	X	(C5	C7)	(+-)	65.11
	=	1399.93	+ 7.72	X	(C6	T1)	(+-)	65.31
	=	1302.65	+ 8.88	X	(C7	T2)	(+-)	63.93
	=	1187.11	+10.32	X	(T1	T3)	(+-)	61.91
	=	1153.86	+10.54	X	(T2	T4)	(+-)	61.50
	=	1180.34	+ 9.69	X	(T3	T5)	(+-)	62.15
	=	1261.43	+ 8.26	X	(T4	T6)	(+-)	63.48
	=	1303.24	+ 7.33	X	(T5	T7)	(+-)	64.51
	=	1304.65	+ 7.12	X	(T6	T8)	(+-)	64.74
	=	1261.38	+ 7.64	X	(T7	T9)	(+-)	64.64
	=	1190.76	+ 8.47	X	(T8	T10)	(+-)	63.26
	=	1131.83	+ 8.91	X	(T9	T11)	(+-)	61.77
	=	1092.70	+ 8.90	X	(T10	T12)	(+-)	60.06
	=	950.59	+ 9.67	X	(T11	L1)	(+-)	57.55
	=	900.02	+10.39	X	(T12	L2)	(+-)	55.52
	=	900.80	+10.05	X	(L1	L3)	(+-)	55.06
	=	900.89	+ 9.14	X	(L2	L4)	(+-)	55.82
	=	1142.38	+ 7.16	X	(L3	L5)	(+-)	60.20
	=	1282.87	+ 5.88	X	(C2	C5)	(+-)	62.73
	=	1476.95	+ 4.99	X	(C3	C6)	(+-)	66.55
	=	1447.08	+ 5.49	X	(C4	C7)	(+-)	66.07
	=	1398.17	+ 6.00	X	(C5	T1)	(+-)	65.26
	=	1321.31	+ 6.72	X	(C6	T2)	(+-)	64.17
	=	1213.00	+ 7.75	X	(C7	T3)	(+-)	62.45
	=	1143.51	+ 8.24	X	(T1	T4)	(+-)	61.40
	=	1162.94	+ 7.70	X	(T2	T5)	(+-)	61.74
	=	1200.45	+ 7.04	X	(T3	T6)	(+-)	62.40
	=	1263.85	+ 6.07	X	(T4	T7)	(+-)	63.88
	=	1270.90	+ 5.83	X	(T5	T8)	(+-)	64.15
	=	1259.77	+ 5.82	X	(T6	T9)	(+-)	64.34
	=	1214.73	+ 6.16	X	(T7	T10)	(+-)	63.77
	=	1123.93	+ 6.91	X	(T8	T11)	(+-)	61.86
	=	1072.11	+ 7.09	X	(T9	T12)	(+-)	60.41
	=	1080.99	+ 7.38	X	(T10	L1)	(+-)	59.20
	=	915.12	+ 7.85	X	(T11	L2)	(+-)	56.93
	=	892.29	+ 7.80	X	(T12	L3)	(+-)	54.98
	=	921.58	+ 7.41	X	(L1	L4)	(+-)	54.98
	=	1056.18	+ 6.16	X	(L2	L5)	(+-)	58.59
	=	1297.10	+ 4.28	X	(C2	C6)	(+-)	61.80
	=	1480.34	+ 4.17	X	(C3	C7)	(+-)	66.33
	=	1505.46	+ 4.91	X	(C4	T1)	(+-)	66.74
	=	1391.00	+ 5.45	X	(C5	T2)	(+-)	64.79
	=	1239.21	+ 6.18	X	(C6	T3)	(+-)	62.65
	=	1166.97	+ 6.60	X	(C7	T4)	(+-)	61.85

Table 5

REGRESSION FORMULAE FOR NEGRO MALES
(CONTINUED)

STATURE	=	1140.51	+	6.53	X	(T1	T5)	(+-)	61.43
	=	1172.99	+	5.98	X	(T2	T6)	(+-)	61.97
	=	1213.18	+	5.43	X	(T3	T7)	(+-)	62.97
	=	1230.81	+	5.04	X	(T4	T8)	(+-)	63.65
	=	1230.06	+	5.00	X	(T5	T9)	(+-)	63.81
	=	1222.30	+	4.92	X	(T6	T10)	(+-)	63.69
	=	1152.24	+	5.36	X	(T7	T11)	(+-)	62.53
	=	1068.82	+	5.83	X	(T8	T12)	(+-)	60.65
	=	989.69	+	6.17	X	(T9	L1)	(+-)	58.68
	=	927.71	+	6.36	X	(T10	L2)	(+-)	56.69
	=	896.89	+	6.34	X	(T11	L3)	(+-)	55.33
	=	900.38	+	6.16	X	(T12	L4)	(+-)	54.72
	=	991.97	+	5.40	X	(L1	L5)	(+-)	57.35
	=	1300.83	+	4.13	X	(C2	C7)	(+-)	63.35
	=	1414.99	+	3.88	X	(C3	T1)	(+-)	65.69
	=	1334.50	+	4.58	X	(C4	T2)	(+-)	64.45
	=	1256.82	+	5.14	X	(C5	T3)	(+-)	63.11
	=	1193.34	+	5.47	X	(C6	T4)	(+-)	62.24
	=	1155.82	+	5.50	X	(C7	T5)	(+-)	61.74
	=	1145.89	+	5.32	X	(T1	T6)	(+-)	61.58
	=	1185.37	+	4.81	X	(T2	T7)	(+-)	62.51
	=	1196.78	+	4.68	X	(T3	T8)	(+-)	62.87
	=	1204.37	+	4.44	X	(T4	T9)	(+-)	63.37
	=	1197.61	+	4.36	X	(T5	T10)	(+-)	63.26
	=	1169.05	+	4.41	X	(T6	T11)	(+-)	62.67
	=	1096.02	+	4.76	X	(T7	T12)	(+-)	61.35
	=	994.48	+	5.23	X	(T8	L1)	(+-)	59.07
	=	922.84	+	5.49	X	(T9	L2)	(+-)	57.26
	=	904.26	+	5.37	X	(T10	L3)	(+-)	55.89
	=	897.78	+	5.24	X	(T11	L4)	(+-)	54.94
	=	961.19	+	4.74	X	(T12	L5)	(+-)	56.83
	=	1263.31	+	3.75	X	(C2	T1)	(+-)	63.89
	=	1358.69	+	3.73	X	(C3	T2)	(+-)	64.08
	=	1267.04	+	4.41	X	(C4	T3)	(+-)	63.39
	=	1212.77	+	4.67	X	(C5	T4)	(+-)	62.73
	=	1175.77	+	4.73	X	(C6	T5)	(+-)	62.63
	=	1154.65	+	4.64	X	(C7	T6)	(+-)	61.76
	=	1157.08	+	4.41	X	(T1	T7)	(+-)	62.07
	=	1170.65	+	4.10	X	(T2	T8)	(+-)	62.42
	=	1165.55	+	4.12	X	(T3	T9)	(+-)	62.64
	=	1147.88	+	3.93	X	(T4	T10)	(+-)	62.91
	=	1152.38	+	3.96	X	(T5	T11)	(+-)	62.70
	=	1115.29	+	4.02	X	(T6	T12)	(+-)	61.60
	=	1035.29	+	4.39	X	(T7	L1)	(+-)	59.92
	=	931.64	+	4.75	X	(T8	L2)	(+-)	57.73
	=	901.97	+	4.73	X	(T9	L3)	(+-)	56.47

STATURE	=	898.64	+	4.59	X	(T10	L4)	(+-)	55.37
	=	940.36	+	4.19	X	(T11	L5)	(+-)	56.71
	=	1246.51	+	3.52	X	(C2	T2)	(+-)	62.5[illegible]
	=	1296.66	+	3.67	X	(C3	T3)	(+-)	63.32
	=	1243.53	+	4.10	X	(C4	T4)	(+-)	62.79
	=	1192.23	+	4.15	X	(C5	T5)	(+-)	62.26
	=	1169.80	+	4.10	X	(C6	T6)	(+-)	61.98
	=	1168.34	+	3.96	X	(C7	T7)	(+-)	62.15
	=	1143.95	+	3.89	X	(T1	T8)	(+-)	62.80
	=	1141.66	+	3.80	X	(T2	T9)	(+-)	62.[illegible]
	=	1148.10	+	3.68	X	(T3	T10)	(+-)	62.27
	=	1136.85	+	3.60	X	(T4	T11)	(+-)	62.12
	=	1103.88	+	3.64	X	(T5	T12)	(+-)	61.41
	=	1049.56	+	3.78	X	(T6	L1)	(+-)	60.30
	=	963.42	+	4.07	X	(T7	L2)	(+-)	58.64
	=	908.82	+	4.20	X	(T8	L3)	(+-)	56.93
	=	895.66	+	4.12	X	(T9	L4)	(+-)	55.90
	=	943.41	+	3.77	X	(T10	L5)	(+-)	56.85
	=	1201.14	+	3.39	X	(C2	T3)	(+-)	61.8[illegible]
	=	1254.05	+	3.48	X	(C3	T4)	(+-)	63.33
	=	1199.62	+	3.72	X	(C4	T5)	(+-)	62.47
	=	1182.64	+	3.66	X	(C5	T6)	(+-)	62.16
	=	1170.62	+	3.57	X	(C6	T7)	(+-)	62.25
	=	1145.59	+	3.55	X	(C7	T8)	(+-)	62.06
	=	1117.57	+	3.57	X	(T1	T9)	(+-)	61.86
	=	1122.69	+	3.43	X	(T2	T10)	(+-)	61.90
	=	1106.45	+	3.40	X	(T3	T11)	(+-)	61.56
	=	1091.47	+	3.35	X	(T4	T12)	(+-)	61.[illegible]
	=	1045.50	+	3.43	X	(T5	L1)	(+-)	60.25
	=	990.88	+	3.56	X	(T6	L2)	(+-)	59.17
	=	955.30	+	3.68	X	(T7	L3)	(+-)	57.[illegible]
	=	897.44	+	3.73	X	(T8	L4)	(+-)	56.28
	=	937.90	+	3.45	X	(T9	L5)	(+-)	57.17
	=	1169.09	+	3.21	X	(C2	T4)	(+-)	61.44
	=	1227.07	+	3.22	X	(C3	T5)	(+-)	62.[illegible]
	=	1187.83	+	3.34	X	(C4	T6)	(+-)	62.[illegible]
	=	1181.30	+	3.24	X	(C5	T7)	(+-)	62.[illegible]
	=	1163.97	+	3.25	X	(C6	T8)	(+-)	62.11
	=	1143.79	+	3.28	X	(C7	T9)	(+-)	61.[illegible]
	=	1100.66	+	3.24	X	(T1	T10)	(+-)	61.[illegible]
	=	1087.60	+	3.19	X	(T2	T11)	(+-)	61.[illegible]
	=	1063.40	+	3.18	X	(T3	T12)	(+-)	60.[illegible]
	=	1058.19	+	3.12	X	(T4	L1)	(+-)	60.16
	=	992.73	+	3.20	X	(T5	L2)	(+-)	58.15
	=	968.06	+	3.27	X	(T6	L3)	(+-)	58.26
	=	917.82	+	3.34	X	(T7	L4)	(+-)	57.04

Table 5

REGRESSION FORMULAE FOR NEGRO MALES
(CONTINUED)

STATURE	=	953.25	+	3.10	X	(T8	L5)	(+-)	57.34
	=	1150.25	+	2.99	X	(C2	T5)	(+-)	61.21
	=	1211.83	+	2.95	X	(C3	T6)	(+-)	62.76
	=	1185.07	+	2.99	X	(C4	T7)	(+-)	62.49
	=	1164.13	+	2.98	X	(C5	T8)	(+-)	62.23
	=	1128.67	+	3.03	X	(C6	T9)	(+-)	61.93
	=	1102.44	+	3.01	X	(C7	T10)	(+-)	61.57
	=	1058.39	+	3.03	X	(T1	T11)	(+-)	60.92
	=	1050.23	+	2.99	X	(T2	T12)	(+-)	60.48
	=	1017.57	+	3.01	X	(T3	L1)	(+-)	59.76
	=	989.42	+	3.02	X	(T4	L2)	(+-)	59.17
	=	962.37	+	3.02	X	(T5	L3)	(+-)	58.36
	=	938.41	+	3.01	X	(T6	L4)	(+-)	57.51
	=	946.25	+	2.99	X	(T7	L5)	(+-)	57.86
	=	1139.33	+	2.76	X	(C2	T6)	(+-)	61.12
	=	1205.73	+	2.68	X	(C3	T7)	(+-)	62.84
	=	1167.55	+	2.77	X	(C4	T8)	(+-)	62.32
	=	1139.70	+	2.79	X	(C5	T9)	(+-)	62.04
	=	1110.85	+	2.80	X	(C6	T10)	(+-)	61.65
	=	1070.54	+	2.84	X	(C7	T11)	(+-)	60.96
	=	1034.01	+	2.85	X	(T1	T12)	(+-)	60.22
	=	1007.14	+	2.84	X	(T2	L1)	(+-)	59.59
	=	973.15	+	2.87	X	(T3	L2)	(+-)	58.85
	=	959.81	+	2.82	X	(T4	L3)	(+-)	58.38
	=	948.35	+	2.80	X	(T5	L4)	(+-)	57.62
	=	961.61	+	2.65	X	(T6	L5)	(+-)	58.19
	=	1136.62	+	2.54	X	(C2	T7)	(+-)	61.29
	=	1187.75	+	2.51	X	(C3	T8)	(+-)	62.65
	=	1143.85	+	2.61	X	(C4	T9)	(+-)	62.13
	=	1121.53	+	2.60	X	(C5	T10)	(+-)	61.76
	=	1079.57	+	2.65	X	(C6	T11)	(+-)	61.06
	=	1037.21	+	2.68	X	(C7	T12)	(+-)	60.28
	=	995.02	+	2.71	X	(T1	L1)	(+-)	59.49
	=	966.53	+	2.71	X	(T2	L2)	(+-)	58.75
	=	946.01	+	2.69	X	(T3	L3)	(+-)	58.11
	=	937.17	+	2.64	X	(T4	L4)	(+-)	57.65
	=	959.43	+	2.48	X	(T5	L5)	(+-)	58.21
	=	1121.14	+	2.39	X	(C2	T8)	(+-)	61.17
	=	1165.22	+	2.38	X	(C3	T9)	(+-)	62.44
	=	1125.80	+	2.45	X	(C4	T10)	(+-)	61.86
	=	1098.45	+	2.48	X	(C5	T11)	(+-)	61.12
	=	1056.73	+	2.52	X	(C6	T12)	(+-)	60.30
	=	999.01	+	2.56	X	(C7	L1)	(+-)	59.38
	=	967.42	+	2.59	X	(T1	L2)	(+-)	58.62
	=	941.30	+	2.55	X	(T2	L3)	(+-)	58.05
	=	924.61	+	2.53	X	(T3	L4)	(+-)	57.41

STATURE	=	953.53	+	2.37	X	(T4	L5)	(+-)	58.17
	=	1099.60	+	2.29	X	(C2	T9)	(+-)	61.01
	=	1143.75	+	2.25	X	(C3	T10)	(+-)	62.15
	=	1095.86	+	2.34	X	(C4	T11)	(+-)	61.31
	=	1057.95	+	2.37	X	(C5	T12)	(+-)	60.55
	=	1010.46	+	2.41	X	(C6	L1)	(+-)	59.68
	=	963.38	+	2.45	X	(C7	L2)	(+-)	58.74
	=	934.55	+	2.44	X	(T1	L3)	(+-)	57.97
	=	919.76	+	2.40	X	(T2	L4)	(+-)	57.36
	=	938.56	+	2.28	X	(T3	L5)	(+-)	57.98
	=	1003.96	+	2.17	X	(C2	T10)	(+-)	60.80
	=	1113.68	+	2.17	X	(C3	T11)	(+-)	61.61
	=	1064.71	+	2.24	X	(C4	T12)	(+-)	60.70
	=	1022.72	+	2.27	X	(C5	L1)	(+-)	59.84
	=	974.74	+	2.32	X	(C6	L2)	(+-)	58.92
	=	941.10	+	2.32	X	(C7	L3)	(+-)	58.12
	=	914.15	+	2.31	X	(T1	L4)	(+-)	57.32
	=	932.99	+	2.19	X	(T2	L5)	(+-)	57.82
	=	1008.90	+	2.08	X	(C3	T11)	(+-)	60.34
	=	1062.68	+	2.09	X	(C3	T12)	(+-)	61.02
	=	1030.99	+	2.16	X	(C4	L1)	(+-)	60.01
	=	987.96	+	2.19	X	(C5	L2)	(+-)	59.13
	=	952.63	+	2.20	X	(C6	L3)	(+-)	58.33
	=	920.92	+	2.20	X	(C7	L4)	(+-)	57.49
	=	927.19	+	2.10	X	(T1	L5)	(+-)	57.76
	=	1032.63	+	2.00	X	(C3	T12)	(+-)	59.83
	=	1049.37	+	2.02	X	(C3	L1)	(+-)	60.35
	=	996.99	+	2.08	X	(C4	L2)	(+-)	59.33
	=	965.71	+	2.09	X	(C5	L3)	(+-)	58.54
	=	932.14	+	2.09	X	(C6	L4)	(+-)	57.69
	=	933.02	+	2.01	X	(C7	L5)	(+-)	57.80
	=	1005.28	+	1.98	X	(C2	L1)	(+-)	59.26
	=	1015.53	+	1.96	X	(C3	L2)	(+-)	59.68
	=	974.98	+	1.99	X	(C4	L3)	(+-)	58.75
	=	941.38	+	2.00	X	(C5	L4)	(+-)	57.90
	=	942.93	+	1.93	X	(C6	L5)	(+-)	58.02
	=	977.48	+	1.87	X	(C2	L2)	(+-)	58.62
	=	992.56	+	1.88	X	(C3	L3)	(+-)	59.10
	=	953.19	+	1.91	X	(C4	L4)	(+-)	58.14
	=	926.81	+	1.91	X	(C5	L5)	(+-)	58.26
	=	958.33	+	1.79	X	(C2	L3)	(+-)	58.19
	=	968.65	+	1.81	X	(C3	L4)	(+-)	58.48
	=	961.69	+	1.77	X	(C4	L5)	(+-)	58.45
	=	939.48	+	1.73	X	(C2	L4)	(+-)	58.61
	=	976.56	+	1.68	X	(C3	L5)	(+-)	58.77
	=	947.70	+	1.61	X	(C2	L5)	(+-)	57.95

Table 6
REGRESSION FORMULAE FOR NEGRO FEMALES
(DIMENSIONS IN MILLIMETERS)

STATURE	=	1020.99	+17.16	X (	C2	C2)	(+-)	59.41
	=	1407.53	+12.97	X (	C3	C3)	(+-)	68.33
	=	1306.87	+19.89	X (	C4	C4)	(+-)	67.11
	=	1287.85	+27.37	X (	C5	C5)	(+-)	65.17
	=	1304.84	+26.25	X (	C6	C6)	(+-)	65.56
	=	1094.45	+39.59	X (	C7	C7)	(+-)	61.18
	=	993.23	+40.76	X (	T1	T1)	(+-)	58.36
	=	001.17	+48.10	X (	T2	T2)	(+-)	56.50
	=	1049.25	+33.52	X (	T3	T3)	(+-)	61.41
	=	1102.59	+29.93	X (	T4	T4)	(+-)	62.43
	=	993.26	+35.24	X (	T5	T5)	(+-)	60.06
	=	1045.77	+31.31	X (	T6	T6)	(+-)	61.19
	=	1087.36	+28.36	X (	T7	T7)	(+-)	62.75
	=	1112.76	+26.40	X (	T8	T8)	(+-)	63.32
	=	1125.86	+24.97	X (	T9	T9)	(+-)	63.49
	=	050.02	+36.20	X (	T10	T10)	(+-)	55.75
	=	1064.69	+24.83	X (	T11	T11)	(+-)	60.68
	=	997.17	+25.62	X (	T12	T12)	(+-)	56.91
	=	931.38	+26.08	X (	L1	L1)	(+-)	57.03
	=	1023.89	+22.60	X (	L2	L2)	(+-)	59.61
	=	1014.97	+23.44	X (	L3	L3)	(+-)	57.91
	=	1021.06	+22.31	X (	L4	L4)	(+-)	57.69
	=	1265.69	+13.25	X (	L5	L5)	(+-)	65.77
	=	1046.87	+17.14	X (	C2	C3)	(+-)	61.37
	=	1404.10	+ 9.13	X (	C3	C4)	(+-)	67.60
	=	1310.71	+10.78	X (	C4	C5)	(+-)	65.95
	=	1265.80	+14.05	X (	C5	C6)	(+-)	64.91
	=	1134.64	+19.11	X (	C6	C7)	(+-)	62.61
	=	984.44	+22.14	X (	C7	T1)	(+-)	58.73
	=	811.43	+25.20	X (	T1	T2)	(+-)	55.26
	=	834.94	+23.26	X (	T2	T3)	(+-)	57.18
	=	1031.66	+17.12	X (	T3	T4)	(+-)	61.30
	=	902.76	+17.85	X (	T4	T5)	(+-)	60.46
	=	964.73	+18.11	X (	T5	T6)	(+-)	59.79
	=	1025.53	+15.99	X (	T6	T7)	(+-)	61.42
	=	1059.02	+11.74	X (	T7	T8)	(+-)	62.52
	=	1078.45	+13.86	X (	T8	T9)	(+-)	62.50
	=	911.50	+17.55	X (	T9	T10)	(+-)	58.62
	=	921.35	+16.07	X (	T10	T11)	(+-)	57.65
	=	908.07	+13.50	X (	T11	T12)	(+-)	58.03
	=	929.51	+13.93	X (	T12	L1)	(+-)	56.16
	=	955.95	+13.14	X (	L1	L2)	(+-)	56.59
	=	941.40	+12.47	X (	L2	L3)	(+-)	57.71
	=	961.63	+12.02	X (	L3	L4)	(+-)	56.61
	=	1073.71	+10.15	X (	L4	L5)	(+-)	61.34
	=	1054.35	+ 9.39	X (	C2	C4)	(+-)	62.10

STATURE	=	1340.09	+ 7.86	X (	C3	C5)	(+-)	66.63
	=	1283.63	+ 9.42	X (	C4	C6)	(+-)	65.45
	=	1141.26	+12.84	X (	C5	C7)	(+-)	62.82
	=	1016.79	+14.76	X (	C6	T1)	(+-)	60.11
	=	833.39	+17.32	X (	C7	T2)	(+-)	56.00
	=	784.09	+16.99	X (	T1	T3)	(+-)	55.67
	=	871.61	+14.64	X (	T2	T4)	(+-)	58.25
	=	975.61	+12.34	X (	T3	T5)	(+-)	60.24
	=	960.37	+12.32	X (	T4	T6)	(+-)	59.95
	=	958.27	+12.03	X (	T5	T7)	(+-)	60.16
	=	1020.24	+10.63	X (	T6	T8)	(+-)	61.63
	=	1045.46	+ 9.92	X (	T7	T9)	(+-)	62.40
	=	922.97	+11.57	X (	T8	T10)	(+-)	58.60
	=	905.84	+11.26	X (	T9	T11)	(+-)	58.45
	=	903.36	+10.52	X (	T10	T12)	(+-)	56.54
	=	926.06	+ 9.61	X (	T11	L1)	(+-)	56.65
	=	908.17	+ 9.34	X (	T12	L2)	(+-)	56.40
	=	908.82	+ 8.99	X (	L1	L3)	(+-)	56.61
	=	916.99	+ 8.75	X (	L2	L4)	(+-)	56.33
	=	953.43	+ 7.75	X (	L3	L5)	(+-)	58.22
	=	1056.70	+ 7.92	X (	C2	C5)	(+-)	61.98
	=	1304.27	+ 6.61	X (	C3	C6)	(+-)	66.10
	=	1181.67	+ 8.92	X (	C4	C7)	(+-)	63.61
	=	1031.49	+11.15	X (	C5	T1)	(+-)	60.82
	=	801.87	+12.81	X (	C6	T2)	(+-)	57.61
	=	784.58	+13.35	X (	C7	T3)	(+-)	55.72
	=	905.64	+12.23	X (	T1	T4)	(+-)	56.61
	=	862.92	+10.98	X (	T2	T5)	(+-)	58.07
	=	953.16	+ 9.44	X (	T3	T6)	(+-)	59.87
	=	942.03	+ 9.38	X (	T4	T7)	(+-)	59.97
	=	961.91	+ 8.85	X (	T5	T8)	(+-)	60.53
	=	1010.86	+ 7.98	X (	T6	T9)	(+-)	61.65
	=	925.85	+ 8.78	X (	T7	T10)	(+-)	59.88
	=	897.11	+ 8.74	X (	T8	T11)	(+-)	58.85
	=	885.19	+ 8.39	X (	T9	T12)	(+-)	57.11
	=	869.01	+ 8.04	X (	T10	L1)	(+-)	55.77
	=	901.78	+ 7.28	X (	T11	L2)	(+-)	55.65
	=	878.63	+ 7.17	X (	T12	L3)	(+-)	55.60
	=	870.97	+ 7.06	X (	L1	L4)	(+-)	55.49
	=	940.86	+ 6.32	X (	L2	L5)	(+-)	57.26
	=	1062.68	+ 6.60	X (	C2	C6)	(+-)	62.13
	=	1213.88	+ 6.63	X (	C3	C7)	(+-)	64.71
	=	1076.13	+ 8.40	X (	C4	T1)	(+-)	61.83
	=	912.82	+10.17	X (	C5	T2)	(+-)	58.48
	=	814.12	+10.77	X (	C6	T3)	(+-)	56.75
	=	791.23	+10.36	X (	C7	T4)	(+-)	56.30

Table 6
REGRESSION FORMULAE FOR NEGRO FEMALES
(CONTINUED)

STATURE	=	805.60	+	9.64	X	T1	T5	(+-)	56.69
	=	863.74	+	8.66	X	T2	T6	(+-)	58.15
	=	934.52	+	7.66	X	T3	T7	(+-)	59.85
	=	935.76	+	7.46	X	T4	T8	(+-)	58.14
	=	961.77	+	6.89	X	T5	T9	(+-)	58.72
	=	917.73	+	7.20	X	T6	T10	(+-)	59.66
	=	888.53	+	7.20	X	T7	T11	(+-)	58.98
	=	865.83	+	7.05	X	T8	T12	(+-)	57.39
	=	849.06	+	6.80	X	T9	L1	(+-)	56.20
	=	854.13	+	6.39	X	T10	L2	(+-)	55.71
	=	870.18	+	5.95	X	T11	L3	(+-)	55.78
	=	838.35	+	5.99	X	T12	L4	(+-)	54.55
	=	889.72	+	5.48	X	L1	L5	(+-)	57.13
	=	1010.03	+	6.31	X	C2	C7	(+-)	61.19
	=	1115.54	+	6.55	X	C3	T1	(+-)	62.98
	=	964.74	+	8.04	X	C4	T2	(+-)	59.86
	=	844.14	+	8.94	X	C5	T3	(+-)	57.49
	=	803.30	+	8.86	X	C6	T4	(+-)	56.86
	=	787.77	+	8.51	X	C7	T5	(+-)	56.32
	=	814.00	+	7.83	X	T1	T6	(+-)	56.38
	=	854.71	+	7.15	X	T2	T7	(+-)	58.38
	=	923.57	+	6.40	X	T3	T8	(+-)	59.90
	=	932.76	+	6.15	X	T4	T9	(+-)	60.27
	=	897.25	+	6.35	X	T5	T10	(+-)	59.08
	=	881.30	+	6.15	X	T6	T11	(+-)	58.84
	=	856.78	+	6.11	X	T7	T12	(+-)	57.51
	=	838.32	+	5.95	X	T8	L1	(+-)	56.43
	=	834.88	+	5.62	X	T9	L2	(+-)	55.99
	=	831.77	+	5.36	X	T10	L3	(+-)	55.84
	=	828.58	+	5.18	X	T11	L4	(+-)	54.68
	=	849.24	+	4.89	X	T12	L5	(+-)	55.96
	=	945.87	+	5.00	X	C2	T1	(+-)	59.91
	=	1010.73	+	5.50	X	C3	T2	(+-)	61.20
	=	894.35	+	7.35	X	C4	T3	(+-)	58.81
	=	823.23	+	7.65	X	C5	T4	(+-)	57.35
	=	793.13	+	7.52	X	C6	T5	(+-)	56.69
	=	790.33	+	7.09	X	C7	T6	(+-)	56.59
	=	816.53	+	6.60	X	T1	T7	(+-)	57.35
	=	868.49	+	6.06	X	T2	T8	(+-)	58.63
	=	916.91	+	5.46	X	T3	T9	(+-)	59.97
	=	896.73	+	5.67	X	T4	T10	(+-)	58.00
	=	856.08	+	6.54	X	T5	T11	(+-)	58.57
	=	841.79	+	6.38	X	T6	T12	(+-)	57.48
	=	814.60	+	5.31	X	T7	L1	(+-)	56.53
	=	816.37	+	5.05	X	T8	L2	(+-)	56.13
	=	812.90	+	4.83	X	T9	L3	(+-)	55.25

STATURE	=	794.92	+	4.74	X	T10	L4	(+-)	54.03
	=	834.15	+	4.37	X	T11	L5	(+-)	55.80
	=	871.44	+	5.80	X	C2	T2	(+-)	58.52
	=	942.42	+	6.11	X	C3	T3	(+-)	60.16
	=	864.04	+	5.51	X	C4	T4	(+-)	58.44
	=	805.40	+	6.67	X	C5	T5	(+-)	57.05
	=	792.93	+	6.44	X	C6	T6	(+-)	56.79
	=	797.61	+	6.00	X	C7	T7	(+-)	56.95
	=	810.90	+	5.68	X	T1	T8	(+-)	57.70
	=	859.91	+	5.22	X	T2	T9	(+-)	58.06
	=	854.98	+	5.10	X	T3	T10	(+-)	58.61
	=	837.99	+	5.03	X	T4	T11	(+-)	58.15
	=	823.60	+	4.91	X	T5	T12	(+-)	57.15
	=	807.91	+	4.77	X	T6	L1	(+-)	56.53
	=	840.41	+	4.60	X	T7	L2	(+-)	56.17
	=	795.79	+	4.42	X	T8	L3	(+-)	55.39
	=	778.70	+	4.34	X	T9	L4	(+-)	54.27
	=	800.32	+	4.07	X	T10	L5	(+-)	55.09
	=	822.10	+	5.45	X	C2	T3	(+-)	57.77
	=	905.57	+	5.56	X	C3	T4	(+-)	59.62
	=	837.57	+	5.84	X	C4	T5	(+-)	57.96
	=	800.03	+	5.84	X	C5	T6	(+-)	57.02
	=	791.36	+	5.62	X	C6	T7	(+-)	57.02
	=	800.51	+	5.38	X	C7	T8	(+-)	57.38
	=	824.57	+	4.94	X	T1	T9	(+-)	58.02
	=	809.19	+	4.86	X	T2	T10	(+-)	57.69
	=	826.00	+	4.60	X	T3	T11	(+-)	57.97
	=	807.26	+	4.52	X	T4	T12	(+-)	57.01
	=	780.68	+	4.42	X	T5	L1	(+-)	55.26
	=	791.94	+	4.21	X	T6	L2	(+-)	56.13
	=	780.41	+	4.09	X	T7	L3	(+-)	55.43
	=	763.34	+	4.01	X	T8	L4	(+-)	54.47
	=	786.15	+	3.78	X	T9	L5	(+-)	55.20
	=	794.32	+	5.04	X	C2	T4	(+-)	57.40
	=	872.92	+	5.10	X	C3	T5	(+-)	59.02
	=	824.07	+	5.22	X	C4	T6	(+-)	57.74
	=	794.51	+	5.16	X	C5	T7	(+-)	57.16
	=	792.24	+	4.96	X	C6	T8	(+-)	57.30
	=	806.85	+	4.56	X	C7	T9	(+-)	57.63
	=	782.08	+	4.60	X	T1	T10	(+-)	57.01
	=	785.32	+	4.41	X	T2	T11	(+-)	57.14
	=	795.68	+	4.19	X	T3	T12	(+-)	56.88
	=	773.86	+	4.12	X	T4	L1	(+-)	55.13
	=	773.79	+	3.94	X	T5	L2	(+-)	55.87
	=	770.53	+	3.80	X	T6	L3	(+-)	55.59
	=	790.26	+	3.74	X	T7	L4	(+-)	54.50

Table 6

REGRESSION FORMULAE FOR NEGRO FEMALES
(CONTINUED)

STATURE =	770.84	+ 3.53 X (	T8	L5)	(+-)	55.27
=	772.38	+ 4.67 X (	C2	T5)	(+-)	56.99
=	853.24	+ 4.65 X (	C3	T6)	(+-)	58.67
=	813.42	+ 4.70 X (	C4	T7)	(+-)	57.74
=	792.39	+ 4.63 X (	C5	T8)	(+-)	57.35
=	796.91	+ 4.41 X (	C6	T9)	(+-)	57.58
=	767.92	+ 4.35 X (	C7	T10)	(+-)	56.69
=	781.38	+ 4.19 X (	T1	T11)	(+-)	56.54
=	760.29	+ 4.03 X (	T2	T12)	(+-)	56.15
=	752.73	+ 3.85 X (	T3	L1)	(+-)	56.02
=	759.00	+ 3.71 X (	T4	L2)	(+-)	55.74
=	754.52	+ 3.58 X (	T5	L3)	(+-)	55.17
=	740.42	+ 3.51 X (	T6	L4)	(+-)	54.47
=	758.83	+ 3.32 X (	T7	L5)	(+-)	55.29
=	778.37	+ 4.31 X (	C2	T6)	(+-)	56.78
=	838.59	+ 4.25 X (	C3	T7)	(+-)	58.55
=	806.76	+ 4.26 X (	C4	T8)	(+-)	57.82
=	793.65	+ 4.16 X (	C5	T9)	(+-)	57.57
=	759.66	+ 4.14 X (	C6	T10)	(+-)	56.68
=	748.62	+ 3.99 X (	C7	T11)	(+-)	55.26
=	740.22	+ 3.84 X (	T1	T12)	(+-)	55.65
=	731.40	+ 3.71 X (	T2	L1)	(+-)	55.39
=	740.08	+ 3.50 X (	T3	L2)	(+-)	55.64
=	740.44	+ 3.39 X (	T4	L3)	(+-)	55.07
=	726.90	+ 3.22 X (	T5	L4)	(+-)	54.30
=	743.18	+ 3.14 X (	T6	L5)	(+-)	55.19
=	747.44	+ 3.98 X (	C2	T7)	(+-)	56.72
=	827.12	+ 7.90 X (	C3	T8)	(+-)	58.51
=	803.63	+ 3.87 X (	C4	T9)	(+-)	57.93
=	796.86	+ 3.93 X (	C5	T10)	(+-)	56.68
=	734.62	+ 3.83 X (	C6	T11)	(+-)	56.22
=	729.64	+ 3.67 X (	C7	T12)	(+-)	55.44
=	714.96	+ 3.55 X (	T1	L1)	(+-)	54.96
=	710.84	+ 3.39 X (	T2	L2)	(+-)	55.07
=	730.80	+ 3.22 X (	T3	L3)	(+-)	54.98
=	713.84	+ 3.17 X (	T4	L4)	(+-)	54.23
=	734.90	+ 3.04 X (	T5	L5)	(+-)	55.00
=	737.11	+ 3.70 X (	C2	T8)	(+-)	56.72
=	819.82	+ 3.80 X (	C3	T9)	(+-)	58.51
=	785.97	+ 3.68 X (	C4	T10)	(+-)	57.95
=	734.86	+ 3.65 X (	C5	T11)	(+-)	56.20
=	721.80	+ 3.53 X (	C6	T12)	(+-)	55.42
=	706.68	+ 3.40 X (	C7	L1)	(+-)	54.79
=	704.62	+ 3.25 X (	T1	L2)	(+-)	54.68
=	704.90	+ 3.12 X (	T2	L3)	(+-)	54.47
=	705.80	+ 3.02 X (	T3	L4)	(+-)	54.18

STATURE =	722.27	+ 2.86 X (	T4	L5)	(+-)	54.89
=	730.43	+ 3.44 X (	C2	T9)	(+-)	56.75
=	781.10	+ 3.43 X (	C3	T10)	(+-)	57.62
=	742.03	+ 3.45 X (	C4	T11)	(+-)	56.55
=	715.59	+ 3.39 X (	C5	T12)	(+-)	55.40
=	700.22	+ 3.28 X (	C6	L1)	(+-)	54.81
=	697.07	+ 3.13 X (	C7	L2)	(+-)	54.53
=	691.37	+ 3.01 X (	T1	L3)	(+-)	54.15
=	682.60	+ 2.93 X (	T2	L4)	(+-)	53.73
=	713.69	+ 2.74 X (	T3	L5)	(+-)	54.82
=	699.82	+ 3.29 X (	C2	T10)	(+-)	55.58
=	754.78	+ 3.24 X (	C3	T11)	(+-)	57.06
=	721.17	+ 3.22 X (	C4	T12)	(+-)	55.72
=	686.51	+ 3.16 X (	C5	L1)	(+-)	54.83
=	691.74	+ 3.02 X (	C6	L2)	(+-)	54.56
=	684.77	+ 2.90 X (	C7	L3)	(+-)	54.01
=	670.07	+ 2.83 X (	T1	L4)	(+-)	53.42
=	691.88	+ 2.67 X (	T2	L5)	(+-)	54.35
=	678.26	+ 3.12 X (	C2	T11)	(+-)	55.52
=	731.39	+ 3.05 X (	C3	T12)	(+-)	56.22
=	702.46	+ 3.01 X (	C4	L1)	(+-)	55.15
=	688.69	+ 2.92 X (	C5	L2)	(+-)	54.58
=	680.75	+ 2.81 X (	C6	L3)	(+-)	54.07
=	663.69	+ 2.74 X (	C7	L4)	(+-)	53.31
=	678.96	+ 2.59 X (	T1	L5)	(+-)	54.06
=	660.91	+ 2.94 X (	C2	T12)	(+-)	54.80
=	712.12	+ 2.86 X (	C3	L1)	(+-)	55.64
=	694.59	+ 2.79 X (	C4	L2)	(+-)	54.90
=	678.58	+ 2.72 X (	C5	L3)	(+-)	54.11
=	659.78	+ 2.66 X (	C6	L4)	(+-)	53.37
=	671.45	+ 2.52 X (	C7	L5)	(+-)	53.91
=	647.08	+ 2.76 X (	C2	L1)	(+-)	54.32
=	703.31	+ 2.67 X (	C3	L2)	(+-)	55.36
=	684.35	+ 2.61 X (	C4	L3)	(+-)	54.42
=	657.72	+ 2.58 X (	C5	L4)	(+-)	53.42
=	666.19	+ 2.45 X (	C6	L5)	(+-)	53.92
=	642.69	+ 2.58 X (	C2	L2)	(+-)	54.12
=	682.88	+ 2.50 X (	C3	L3)	(+-)	54.87
=	663.47	+ 2.48 X (	C4	L4)	(+-)	53.78
=	662.97	+ 2.39 X (	C5	L5)	(+-)	53.92
=	636.88	+ 2.42 X (	C2	L3)	(+-)	53.73
=	671.13	+ 2.39 X (	C3	L4)	(+-)	54.18
=	656.91	+ 2.31 X (	C4	L5)	(+-)	54.10
=	617.82	+ 2.31 X (	C3	L4)	(+-)	53.90
=	674.17	+ 2.23 X (	C3	L5)	(+-)	54.58
=	621.11	+ 2.17 X (	C2	L5)	(+-)	53.50

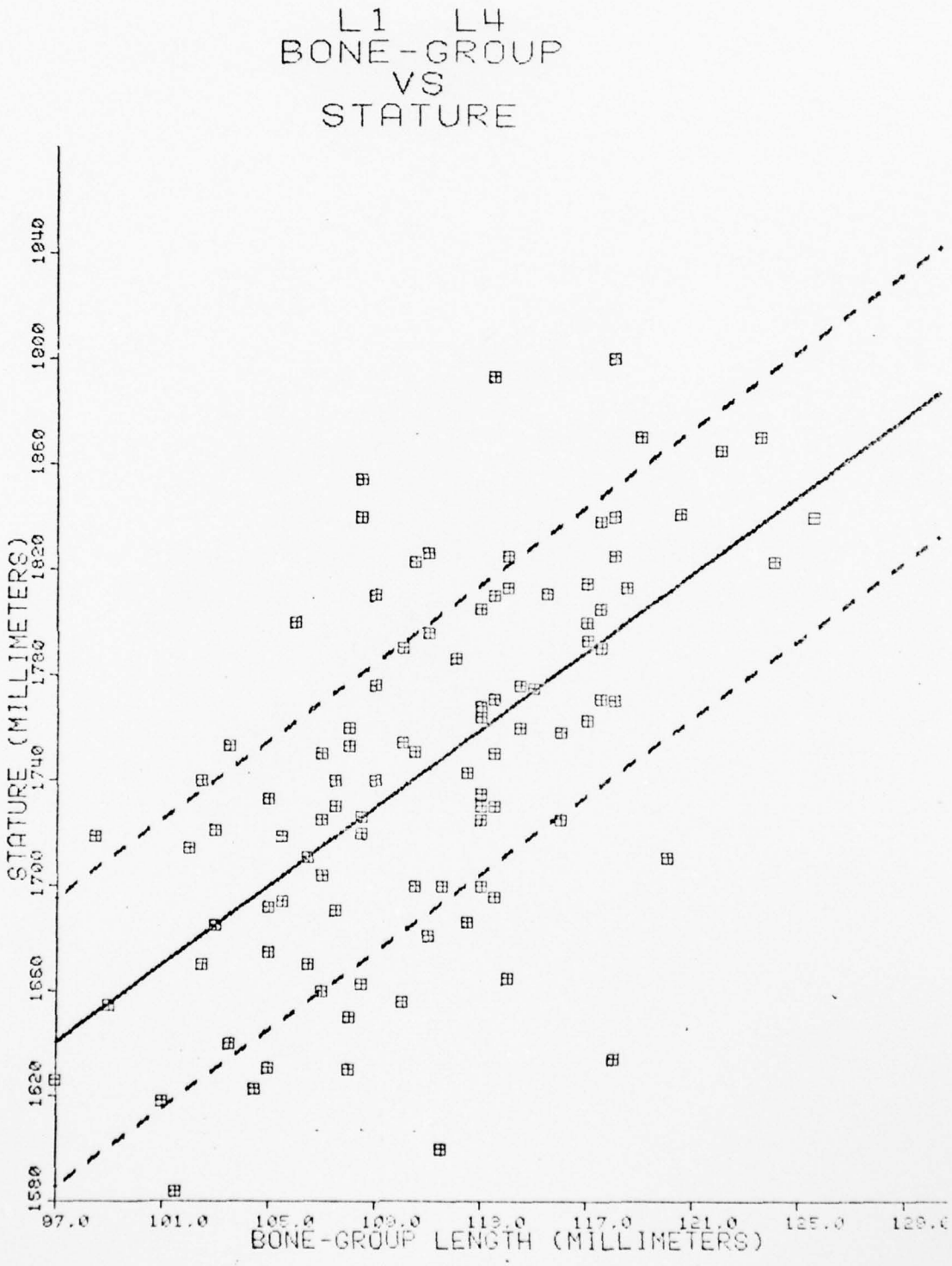

Fig. 7 Scattergram of Negro male data, bone-group L1-L4

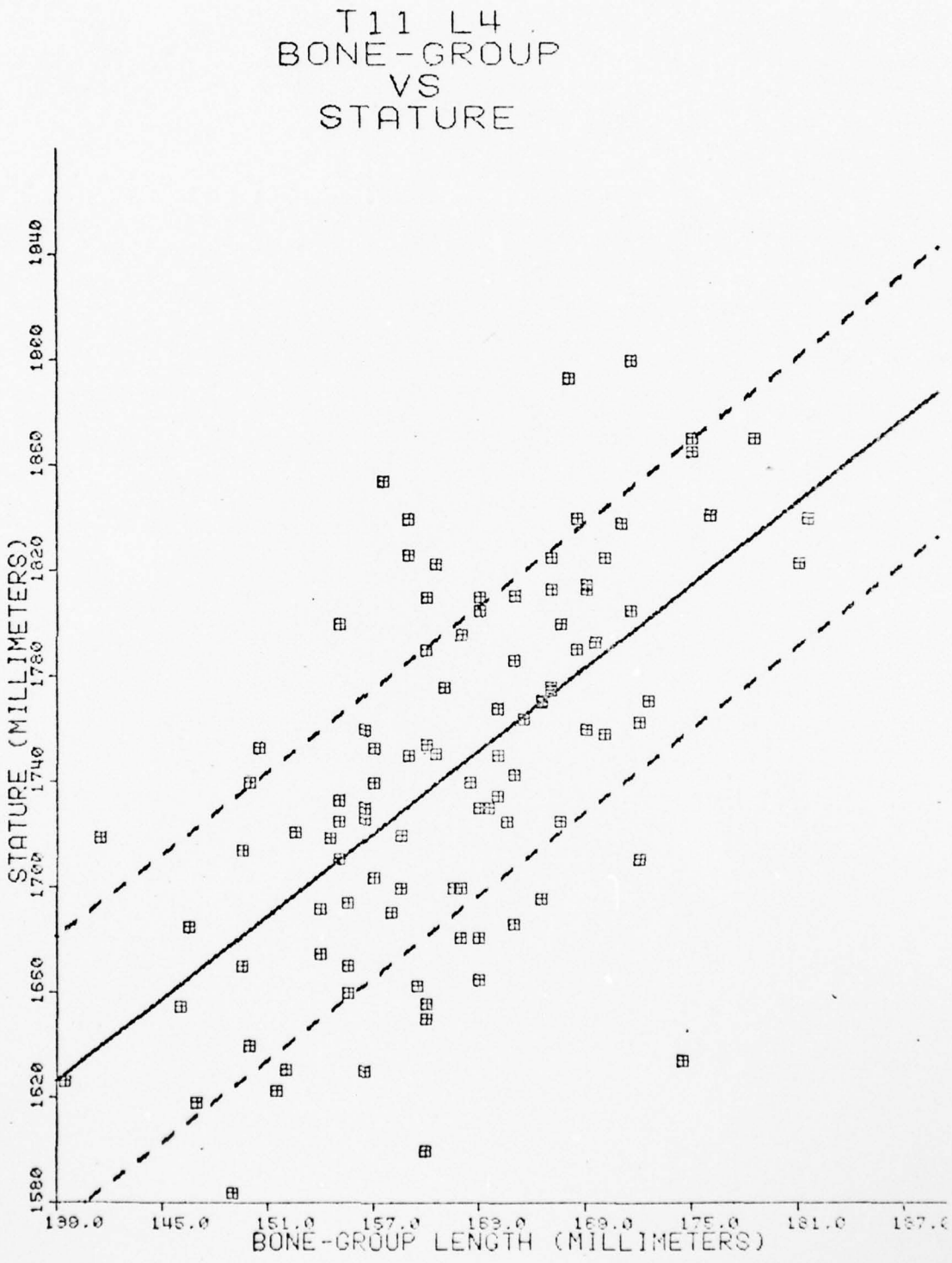

Fig. 8 Scattergram of Negro male data, bone-group T11-L4

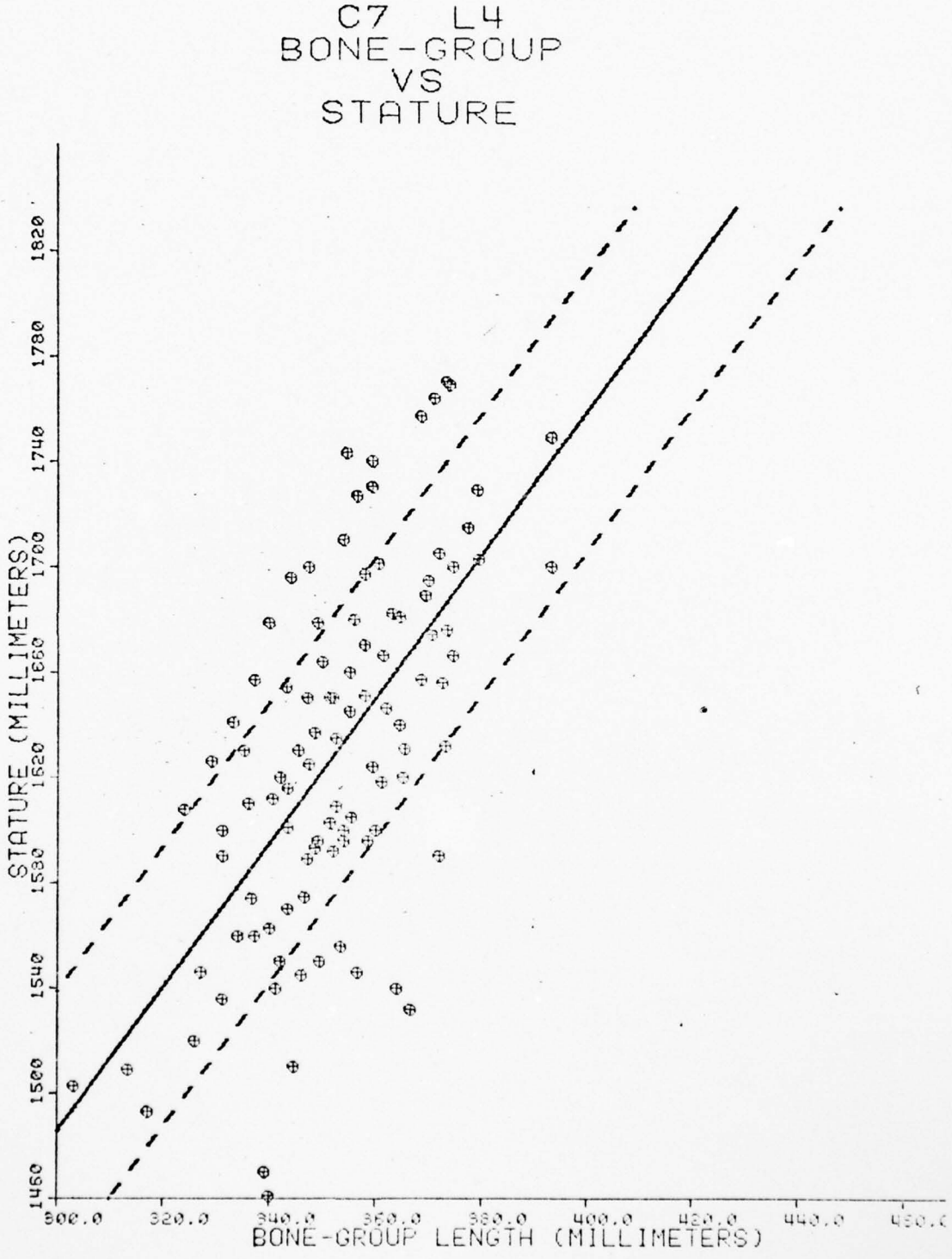

Fig. 9 Scattergram of Negro female data, bone-group C7-L4

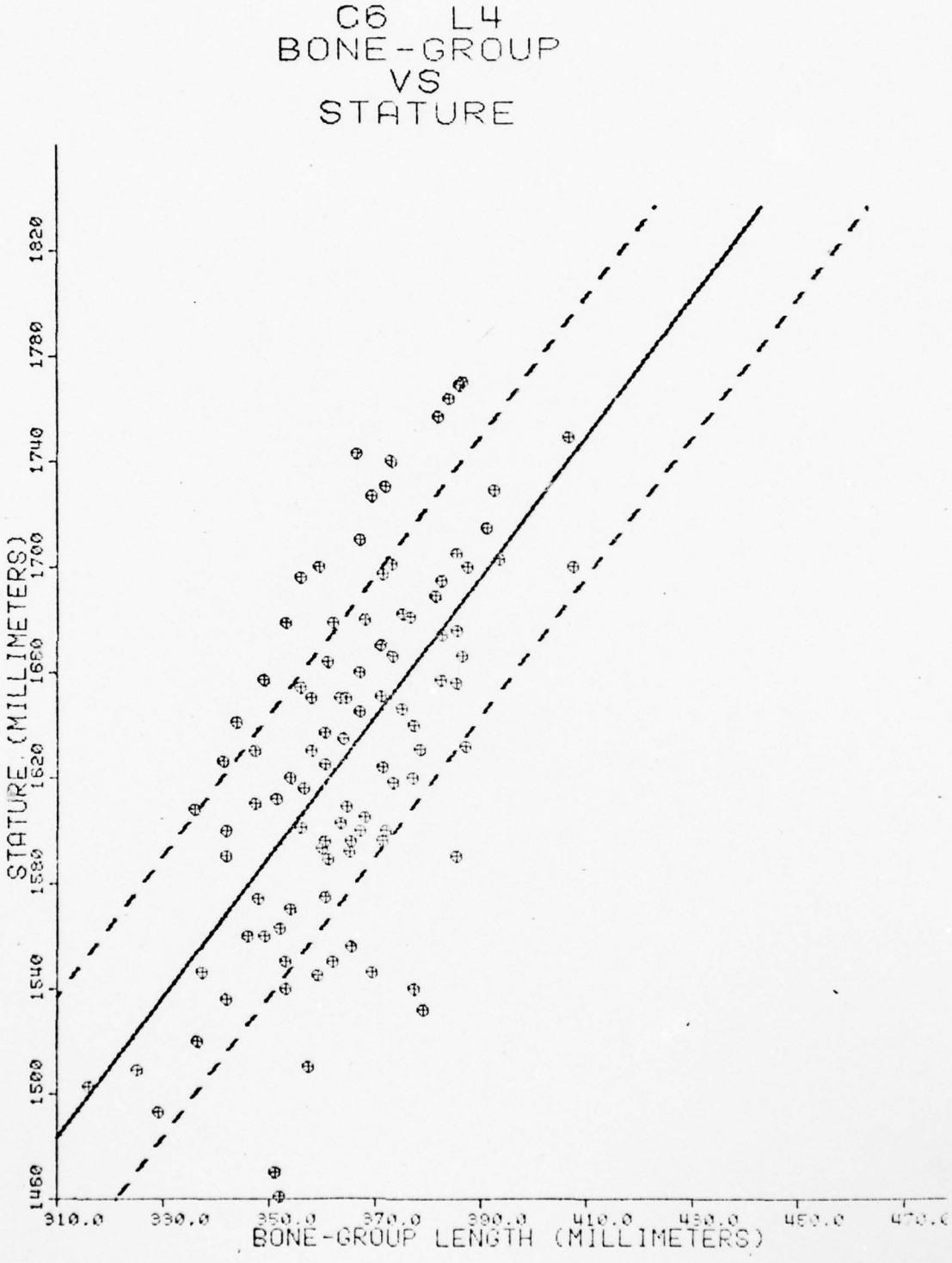

Fig. 10 Scattergram of Negro female data, bone-group C6-L4

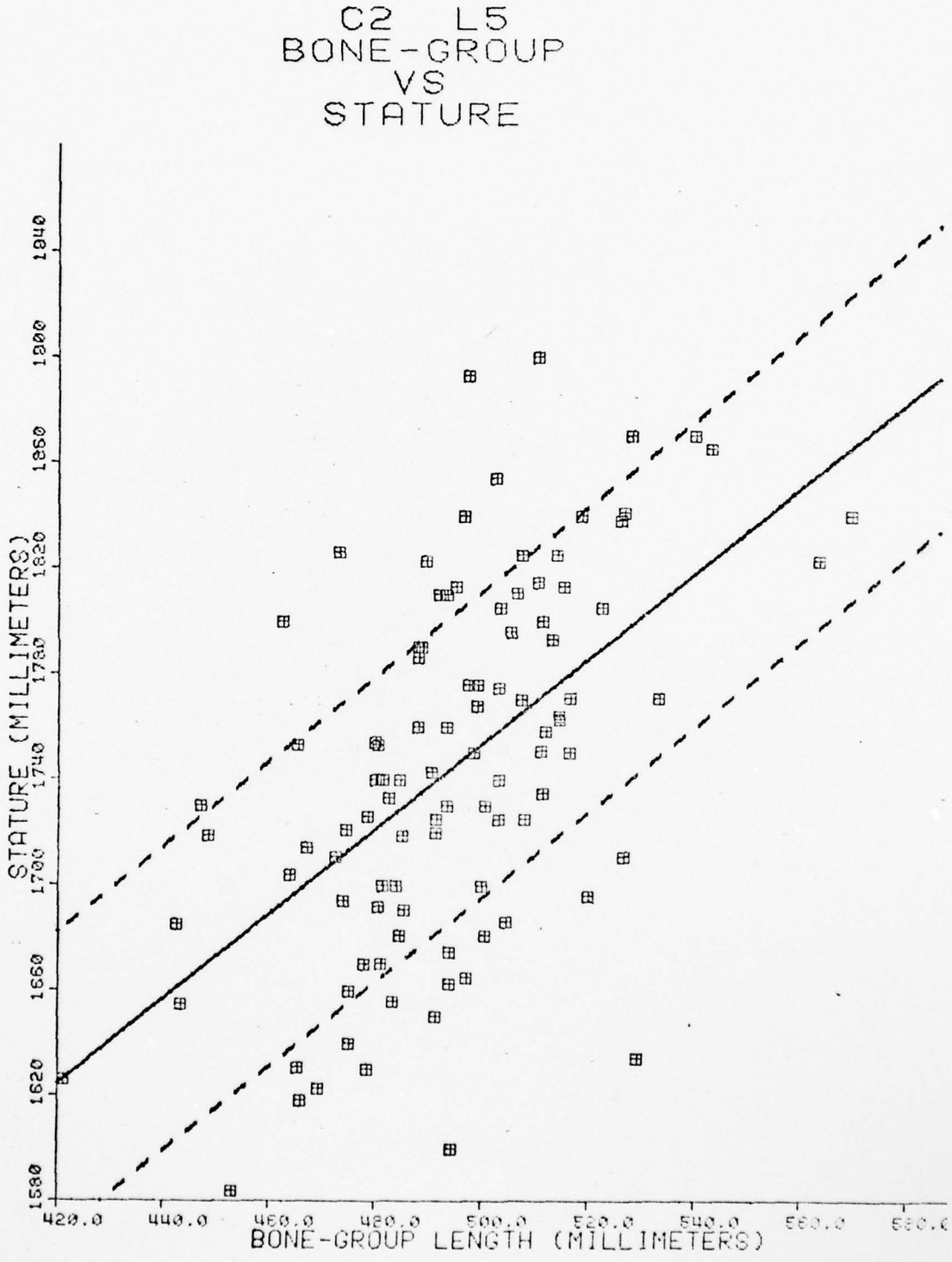

Fig. 11 Scattergram of Negro male data, bone-group C2-L5

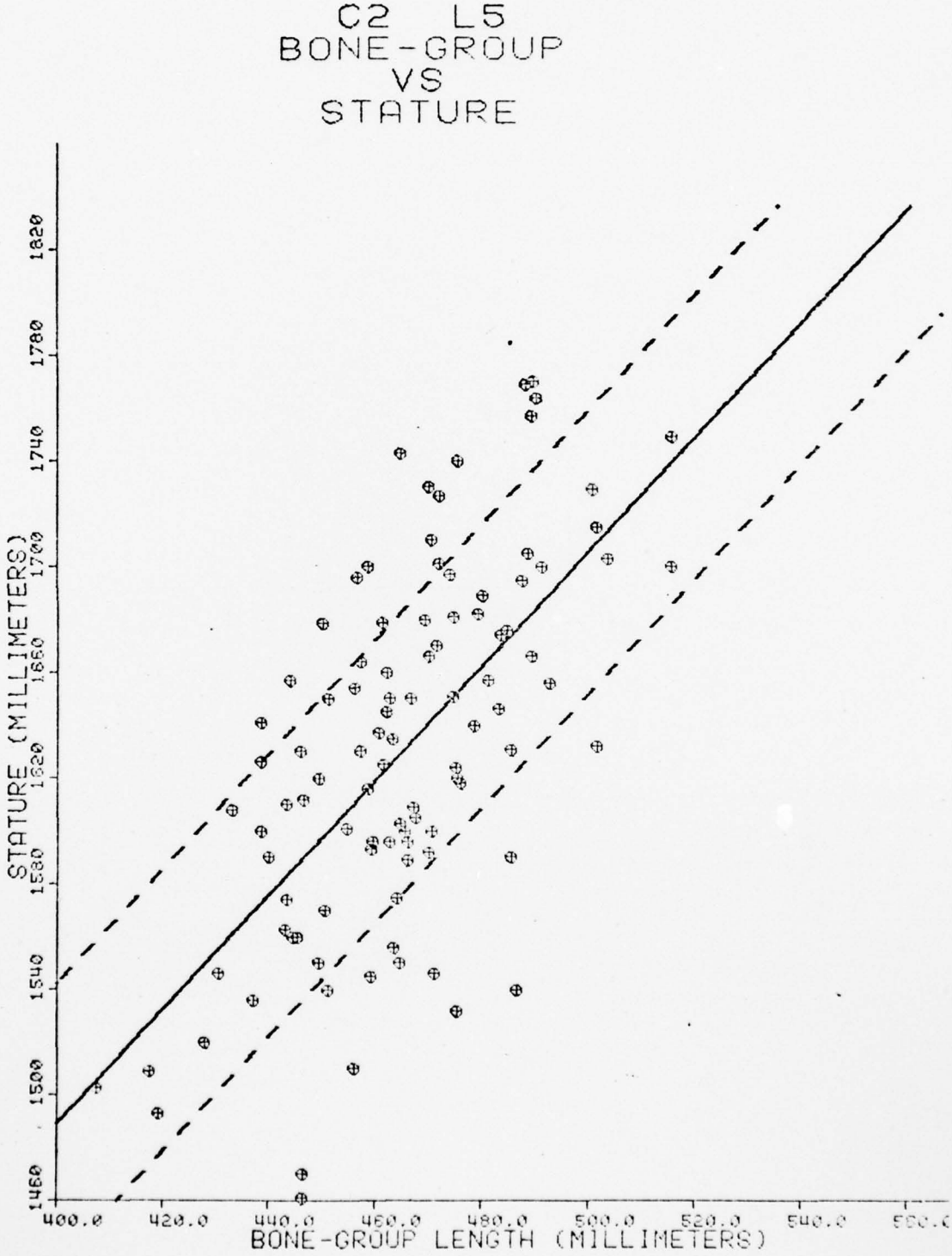

Fig. 12 Scattergram of Negro female data, bone-group C2-L5

VIII. DISCUSSION AND CONCLUSIONS

The coefficients of correlation can be tested to determine whether they are significantly different than a zero correlation. The correlations found in this study are significantly different than zero with only one exception.

The amount of variation in the statures of the current sample which is explained by the variation in the lengths of a bone-group, is equal to the coefficient of correlation squared. For example, if the coefficient of correlation is .50, then .25 or 25% of the variation in stature would be explained by the variation in the bone-group length.

In this study, the highest coefficient of correlation for the males was .62. This indicates that only 38.44% of the variation in stature was explained by the variation in length of the bone-group.

In contrast to this, Trotter and Gleser (1952) found correlations ranging from .712 to .861 for the males and from .633 to .848 for the females. This indicates that as much as 74% and 72% of the variation in statures are explained by the variation in long bone lengths for the males and females, respectively.

The greater the percentage of variation in stature that is attributable to the variation in bone-group length; the smaller the error in estimating stature. It would be expected then, that the standard errors of the regression formulae obtained from the vertebral column would be greater than the standard errors of the formulae from the long bones. This is, indeed, what was found in this research.

The standard errors of the estimates vary from 67.89mm to 54.72mm for the males and from 68.33mm to 53.09mm for the females when using the vertebral regression formulae. These errors vary from 4.74cm (47.4mm) to 3.38cm (33.8mm) for the males and from 5.05cm (50.5mm) to 3.22cm (32.2mm) for the females using long bone formulae (Trotter and Gleser, 1952 and 1958).

The smallest of the standard errors of the estimations based on the vertebral column are significantly different from the standard errors based on the long bones with only three exceptions (equations based on the ulna and on the radius for the females, and based on the ulna for the males).

Based on these statistics, it can be concluded that the vertebral column can be a useful tool in the estimation of stature. It is not, however, as good a tool as are the long bones. If the long bones are available, they should be used for estimating stature.

The low coefficients of correlation (and the high standard errors of the estimate) which were found in this study could have one or both of the following causes: 1) the relationship between vertebral bone-group lengths and stature is not linear or 2) regardless of the relationship there is a large amount of variation in the proportions of individuals. As has been shown by previous researchers (Dwight, 1890; Pearson, 1898; Stevenson, 1929; Dupertuis and Hadden, 1951; Trotter and Gleser, 1951a, 1951b, 1952, 1958; and others), there is a considerable amount of variation among individuals. As Krogman (1961) so aptly put it:

> It is axiomatic in biology that stability is the exception, variability is the rule. That is to say, there really is no average; there is only a central tendency, with a normal range of variability clustering around it.

Whether or not the first possibility is also a contributing factor is unknown. Trotter and Gleser (1952) attempted to show that the relationship between the long bones and stature was linear by computing the mean statures

for 5mm increments in femur length and showing that the correlation ratio for the distribution of means was not significantly different than the correlation coefficient for the femur. This method does not take into account the possibility of an approximately linear relationship in the average height ranges and deviation from that linear approximation in the taller and shorter height ranges, due to the limited number of extremely long or short bone lengths.

Determination of the relationship between bone lengths and stature in extremely tall and extremely short subjects is hampered by the lack of skeletal material to study. Pearson (1898) found that when his regression formulae were applied to dwarf or giant races, the resulting estimations were much too large for the dwarfs and too small for the giants. He theorized a non-linear relationship between long-bone length and stature in order to account for this. Pearson, however, was applying his formulae across racial boundaries, a proceedure which he had, earlier in the same paper, warned against.

In the current study, the author was able to find two skeletons of Negro males in the Terry Collection whose statures were 2 and 2.03 meters. When the regression formulae based on the vertebral column were utilized to estimate their statures the estimates were on the order of 4 to 5 standard errors below the actual statures. This could perhaps indicate that a small increase in vertebral column length implies a much larger stature increase when dealing with tall persons than with shorter persons.

This is a trap into which the investigator may easily fall. By looking at figure 5, it becomes evident that of those male subjects over 1,820mm in stature, all but two would be underestimated by using the regression formula. Similarly, of those subjects under 1,700mm, all but one would be overestimated. This is the nature of the regression formula; it does <u>not</u> give the best straight line representation of the data, instead it gives the best approxi-

mation of the stature given a bone-group length.

The only ways to test the linearity of the relationship between stature and bone length are to use the method employed by Trotter and Gleser mentioned above, with larger numbers of subjects that have bone lengths that are longer or shorter than normal, or to apply non-linear regression analysis to the data.

Schultz (1931) demonstrated that in the male human body, at birth the leg length is 116% of the trunk length, growing to between 151% and 192% in the adult. With this in mind, it would seem logical that, as a person grows, changes in stature would be due more to long bone growth than vertebral column growth. This would account for the higher correlation between long bone length and stature than between vertebral bone-group length and stature, regardless of whether the relationships were linear or non-linear. Linearity or non-linearity would be determined by the respective rates of growth of the bones and the time of cessation of growth.

Fully and Pineau (1960), studying males only, found coefficients of correlation of .926 when they combined the length of the femur and the five lumbar vertebrae and of .908 when they combined the tibia with the lumbar vertebrae. This indicates a very strong linear relationship between stature and these combined bone lengths.

Additional research needs to be conducted to determine the relationships between stature and other vertebral bone-groups combined with the long bones. It would also be worthwhile to investigate the possibility of non-linear relationships between stature and the vertebral bone-groups.

Fully and Pineau also provided a table showing the percentage of total vertebral column length which each vertebra represents, as well as the cumulative percentages from the superior and from the inferior ends of the column. Table 7 shows the values found by Fully and Pineau along with the percentages found in the current study. The values found for the Negro males are almost

Table 7

AVERAGE VERTEBRAL HEIGHT AS PERCENTAGE OF VERTEBRAL COLUMN LENGTH

Vertebra	Individual Percentage			Cumulative Percentage					
				From Superior End			From Inferior End		
	Fully and Pineau	Current Study		Fully and Pineau	Current Study		Fully and Pineau	Current Study	
		Males	Females		Males	Females		Males	Females
C2	7.80	7.70	7.63	7.80	7.70	7.63	100.00	100.00	100.00
C3	2.89	2.81	2.69	10.59	10.51	10.33	92.20	92.30	92.37
C4	2.73	2.72	2.63	13.32	13.23	12.96	89.41	89.49	89.67
C5	2.66	2.64	2.61	15.98	15.87	15.57	86.68	86.78	87.04
C6	2.65	2.67	2.66	18.63	18.54	18.23	84.02	84.13	84.43
C7	2.95	2.94	2.91	21.58	21.47	21.14	81.37	81.46	81.77
T1	3.41	3.42	3.36	24.99	24.90	24.50	78.42	78.53	78.86
T2	3.61	3.70	3.62	28.59	28.60	28.12	75.01	75.10	75.50
T3	3.72	3.80	3.73	32.31	32.40	31.85	71.41	71.40	71.87
T4	3.83	3.83	3.79	36.14	36.23	35.64	67.69	67.60	68.15
T5	3.98	3.93	3.89	40.12	40.16	39.53	63.86	63.77	64.36
T6	4.10	4.07	4.01	44.22	44.23	43.54	59.88	59.84	60.47
T7	4.19	4.17	4.11	48.41	48.40	47.65	55.78	55.77	56.46
T8	4.24	4.26	4.21	52.65	52.66	51.87	51.59	51.60	52.35
T9	4.35	4.36	4.34	57.00	57.02	56.21	47.35	47.34	48.13
T10	4.61	4.61	4.59	61.61	61.63	60.80	43.00	42.98	43.79
T11	4.96	4.94	4.90	66.57	66.56	65.70	38.39	38.38	39.20
T12	5.23	5.28	5.27	71.80	71.84	70.97	33.43	33.44	34.30
L1	5.53	5.55	5.59	77.33	77.39	76.56	28.20	28.16	29.03
L2	5.62	5.60	5.77	82.95	83.00	82.32	22.67	22.61	23.44
L3	5.66	5.66	5.89	88.61	88.66	88.22	17.05	17.00	17.67
L4	5.63	5.63	5.87	94.24	94.29	94.09	11.39	11.35	11.78
L5	5.76	5.71	5.91	100.00	100.00	100.00	5.76	5.71	5.91

identical to those found by Fully and Pineau for White males. The Negro females disclose smaller percentages in C2 through C4 and larger percentages in L2 through L5, being approximately equal to the males in the rest of the column. This indicates the vertebral column of males is proportioned the same across these particular racial bounds while the females are proportionally shorter in the cervical vertebrae and longer in the lumbar vertebrae than are the males. Similarly, Dwight (1894) reported finding that the lumbar region was proportionally longer in females than in males.

Dwight also found a few numerical anomalies (both less than and more than the normal number of vertebrae) although he was unable to provide any information as to how frequent these anomalies appeared. In the current study, anomalies were recorded when found, but were not used in the data base for deriving the regression formulae. Among the males, approximately 5.6% had more than the normal number of vertebrae: four (3.2%) had an extra thoracic vertebrae, and three (2.4%) had an extra lumbar vertebrae. Approximately 2.4% had fewer than the normal number: two (1.6%) had only eleven thoracic vertebrae, and one (0.8%) had only four lumbar vertebrae.

Among the females in the current study, approximately 2.2% had more than the normal number of vertebrae: one (0.7%) had an extra thoracic vertebrae and two (1.5%) had an extra lumbar vertebrae. Approximately 7.4% had fewer than the normal number: six (4.4%) had only eleven thoracic vertebrae, four (2.9%) had only four lumbar vertebrae, and one (0.7%) had only six cervicle and eleven thoracic vertebrae.

Using the data obtained from these abnormal vertebral columns, selected regression formulae were applied to determine the proper proceedure for handling these anomalies.

With a normal vertebral column the proceedure would be to use the regression formula with the smallest standard error for which the vertebrae were

available. For example, if the vertebrae C2 through C5 and T7 through L5 were available from a Negro male, the formula for bone-group T12-L4 would be used to estimate stature.

With vertebral columns that were missing vertebrae or had extra vertebrae, it was found that the proceedure would be the same as for normal vertebrae. If vertebrae are missing, the formula with the smallest standard error for which the vertebrae are available should be used. If there are extra vertebrae, the only difference to the standard proceedure is to disregard the extra vertebra if it happens to be located with the chosen bone-group, i.e., bone-group T10-L1 would contain T13.

In the cases available for study, 72.7% of the estimates on males fell within one standard error when using the above proceedures, and 81.8% were within two standard errors. In four cases in which an extra vertebra fell within the bone-group providing the least standard error, three cases resulted in better estimates by not including the extra vertebra in the calculations.

For the females, 62.5% of the estimates were within one standard error when using the above proceedures, and 100% fell within two standard errors. Only one case was present in which an extra vertebra was included in the bone-group used for the estimations. In this case the regression formula provided a better estimate when the extra vertebra was not used in the calculations.

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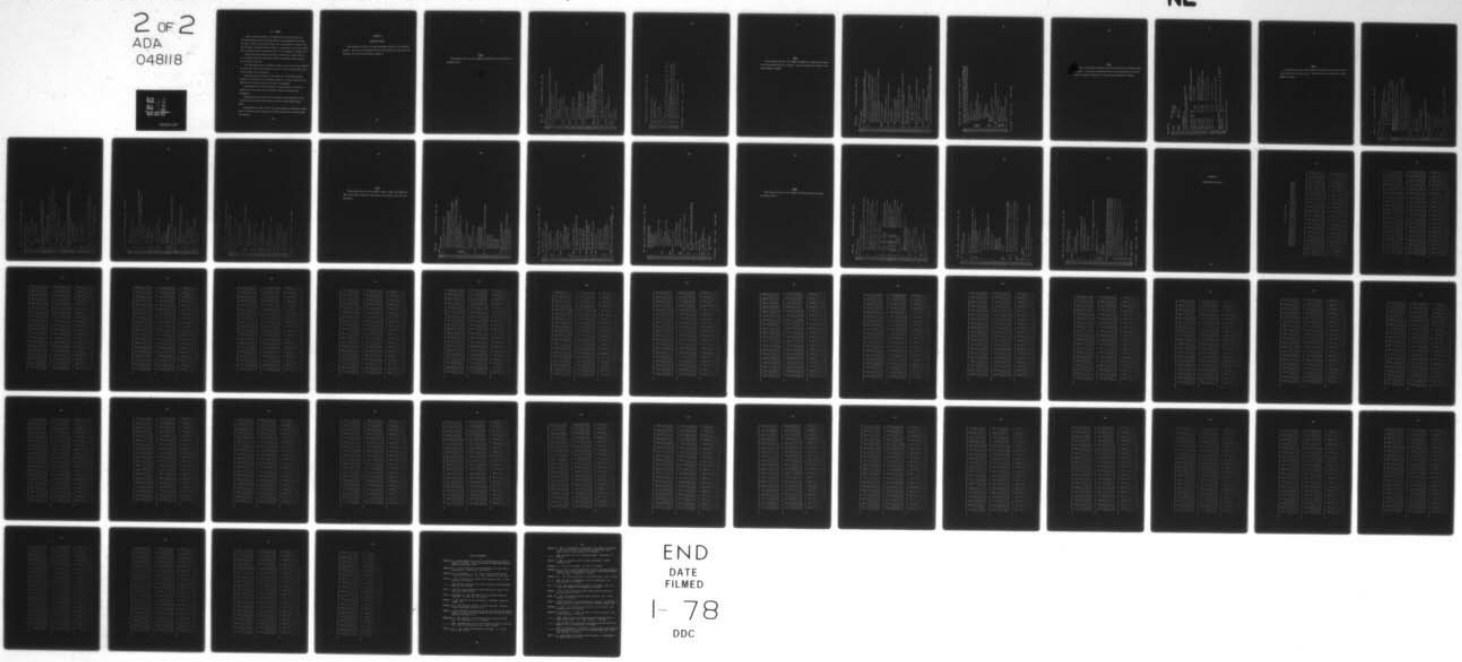

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IX. SUMMARY

Linear regression analysis was applied to data from 100 male and 100 female American Negro skeletons from the Terry Anatomical Collection in order to develop regression formulae for the estimation of stature from the vertebral column and portions thereof. The vertebral column was divided into contiguous sections containing from 1 to 23 vertebrae (C2 through L5).

These bone-groups produced correlation coefficients ranging from .18 to .64 and the resulting regression formulae and standard errors ranging from 53.09mm to 68.33mm.

The study shows that the vertebral column can be an aid in the estimation of stature but that the estimations are not as accurate as those made based on the lengths of the long bones.

There remains some question as to whether the relationship between stature and the length of the vertebral column is, in fact, linear and the possibility of further study in this area is recommended.

The possibility of further studies on the estimation of stature by combining the long bones and the vertebral column was discussed and recommended.

Comparisons were made between the vertebral column proportions found in this study and those found by Fully and Pineau using European White males.

Consideration was also given to the proper method for estimating stature when the vertebral column contains less than or more than the normal number of vertebrae.

APPENDIX A

COMPUTER PROGRAMS

This appendix contains the computer programs utilized in this research project. The use of the programs and their relationships to each other are described in the section beginning on page 47.

LISTS

This program reads the files BONEMA and BONEFE and prints them out in readable format.

```
0001  FTN4,L
0002        PROGRAM LISTS
0003  C
0004  C  THIS PROGRAM READS THE FILE WHICH CONTAINS THE BONE LENGTH DATA
0005  C   AND FORMATS IT IN A READABLE FORM.
0006  C
0007  C  RUN WITH-->  :RU,LISTS,,NO OR PE
0008  C
0009        DIMENSION IDCB(144),INBUF(53),NAME(3),IPAR(5)
0010        INTEGER BODY(3),AGE,HT
0011        REAL BL(23)
0012        EQUIVALENCE (LU,IPAR(1))
0013        DATA NAME/2HBO,2HNE,2HS /
0014  C
0015  C GET THE OPERATOR'S INSTRUCTIONS
0016  C
0017        CALL RMPAR(IPAR)
0018        NAME(3)=IPAR(2)
0019  C
0020  C OPEN THE FILE
0021  C
0022        CALL OPEN(IDCB,IERR,NAME)
0023        IF (IERR.LT.0)  GO TO 4000
0024  C
0025  C  PRINT THE HEADER
0026  C
0027        IF(NAME(3).EQ.2HMA) WRITE(6,1010)
0028        IF(NAME(3).EQ.2HFE) WRITE(6,1011)
0029  C
0030  C NOW READ THE 100 RECORDS IN THE FILE
0031  C  AND PRINT THEM
0032  C
0033        DO 500 I=1,100
0034          CALL READF(IDCB,IERR,INBUF,53)
0035          IF (IERR.LT.0) GO TO 4000
0036          CALL CODE
0037          READ (INBUF,999)BODY,AGE,HT,BL
0038  999     FORMAT(3A2,2X,I2,2X,I4,23(5F3.1))
0039  C  STRIP THE " FROM COLUMN 1 OF INPUT AND SUBSTITUTE A SPACE
0040          BODY(1)=IOR(IAND(BODY(1),177B),020000B)
0041  C
0042  C BEFORE THE 1ST, 22ND, 43RD, 64TH, AND 85TH LINES, PRINT HEADERS
0043  C
0044          IF(I.EQ.22 .OR. I.EQ.43 .OR. I.EQ.64 .OR. I.EQ.85)WRITE(6,997)
0045          IF (I.EQ.1 .OR. I.EQ.22 .OR. I.EQ.43 .OR. I.EQ.64 .OR. I.EQ.85)
0046         C  WRITE(6,1500)
0047  C
0048  C NOW PRINT OUT THE DATA
0049  C
0050          WRITE(6,1005)BODY,AGE,HT,BL
0051  500   CONTINUE
0052  C
0053  C NOW FORM FEED
0054  C
0055        WRITE(6,1020)
0056        GO TO 4005
```

```
0057  C
0058  C  ERROR OF SOME SORT, REPORT IT
0059  C
0060  4000  WRITE(LU,993)IERR
0061  993   FORMAT(" FTN4 ERROR#"I4)
0062  C
0063  C AND CLOSE TAC FILE
0064  C
0065  4005  CALL CLOSE(IBCB)
0066  C
0067  C FORMATS
0068  C
0069  1000  FORMAT("  ID#  AGE  HT   C2   C3   C4   C5   C6   C7   T1   T2   T
0070        C3   T4   T5   T6   T7   T8   T9  T10  T11  T12   L1   L2   L3   L4
0071        C   L5"/"0",129("-")/)
0072  1005  FORMAT(3A2,2X,I2,XI4,2X,14F4.1)/)
0073  1010  FORMAT("1"10/45X"MEASUREMENTS TAKEN ON 100 NEGRO MALE SKELETONS"
0074        C/57X"(IN MILLIMETERS)"3/)
0075  1011  FORMAT("1"10/45X"MEASUREMENTS TAKEN ON 100 NEGRO FEMALE SKELETONS
0076        C"/57X"(IN MILLIMETERS)"3/)
0077  1020  FORMAT(2("1"))
0078  997   FORMAT("1"10/52X"MEASUREMENTS (CONTINUED)"3/)
0079        END
```

** NO ERRORS ** PROGRAM = 00728 COMMON = 00000

GNSEC

This program reads the files BONEMA and BONEFE and computes the lengths of the 276 bone-groups to be analyzed. The data generated is placed in the files SECSMA and SECSFE.

```
0001  FTN4,L
0002        PROGRAM GNSEC
0003  C
0004  C   THIS PROGRAM READS THE FILES CONTAINING THE RAW DATA
0005  C    AND COMPUTES THE 276 BONE GROUP LENGTHS.  THIS IS STORED INTO
0006  C     A FILE CALLED SECONA OR SECSFE.
0007  C
0008  C   THE RUN COMMAND IS -->   :RU,GNSEC,,MA OR FE,[999 TO PRINT]
0009  C
0010        DIMENSION K(23),J(276),IDCB1(144),IDCB2(144),INBUF(53)
0011        DIMENSION INAM1(3),INAM2(3),ISIZ(2),IPAR(5),ISEX(3)
0012        INTEGER AGE,HT,OUBUF(278)
0013        EQUIVALENCE (AGE,OUBUF(1)),(HT,OUBUF(2)),(J,OUBUF(3))
0014        EQUIVALENCE (LU,IPAR(1))
0015        DATA INAM1/2HGO,3HNE,2HMA/,INAM2/2HSE,2HCS,2HMA/,ISIZ/220,278/
0016        DATA ISEX/2HFE,2HMA,2HLE/
0017  C
0018  C GET THE TURN-ON PARAMETERS
0019  C
0020        CALL RMPAR(IPAR)
0021        IF (IPAR(2).EQ.2HMA) ISEX(1)=2H
0022  C
0023  C  MAKE THE INPUT AND OUTPUT FILE NAMES FROM IPAR(2)
0024  C
0025        INAM1(3)=IPAR(2)
0026        INAM2(3)=IPAR(2)
0027  C
0028  C  OPEN THE INPUT AND OUTPUT FILES
0029        CALL OPEN(IDCB1,IERR,INAM1)
0030        IF (IERR.LT.0) GO TO 5000
0031        CALL CREAT(IDCB2,IERR,INAM2,ISIZ,2,5555)
0032        IF (IERR.LT.0) GO TO 5005
0033  C
0034  C  NOW READ DATA FOR EACH SKELETON AND COMPUTE THE LENGTH OF THE
0035  C   VARIOUS GROUPINGS OF THE VERTEBRAE
0036  C
0037  C   DO ALL 100 SKELETONS
0038        DO 600 I=1,100
0039  C   FIRST FILL THE K ARRAY WITH INDIVIDUAL LENGTHS
0040  C
0041          CALL READF(IDCB1,IERR,INBUF,53)
0042          CALL CODE
0043          READ (INBUF,*)AGE,HT,K
0044  C
0045  C  ADJUST THE HEIGHT VALUE BY .6MM PER YEAR OVER 30 YEARS
0046  C
0047        IF(AGE.GT.30)  HT=HT+(.6*(AGE-30))
0048          N=0
0049  C
0050  C  USE IPAR(3) AS A FLAG TO TURN ON PRINT-OUT
0051  C
0052          IF(IPAR(3).NE.999)GO TO 205
0053          IF(I.EQ.1)WRITE(6,210)ISEX
0054  210     FORMAT(////////////5X,3A2" NEGRO DATA SETS"/
0055       C              ///27X,"THIS APPENDIX LISTS THE 276 VARIABLES GENERAT
0056       CED FROM THE MEASUREMENTS OF THE"/27X"INDIVIDUAL VERTEBRAE.  THE FI
```

```
0057          CRST LINE OF EACH DATA SET CONSISTS OF THE DATA"/27X"SET NUMBER, AG
0058          CE, HEIGHT (IN MM), AND VERTEBRAE LENGTHS (IN TENTHS OF MM) FOR"/27
0059          CX"EACH INDIVIDUAL SKELETON.  THE REMAINING LINES SHOW THE LENGTHS
0060          C(IN TENTHS OF"/27X"MM) OF BONE-GROUPS 1 THROUGH 276 AS EXPLAINED I
0061          CN THE TEXT."////)
0062             L=L+1
0063             IF (L.NE.3) GO TO 200
0064             L=0
0065             WRITE(6,250)
0066   250       FORMAT("1"////)
0067   200       WRITE (6,205) I,AGE,HT,K
0068   205       FORMAT(//12X,I3,2X,I2,X,I4,2314/)
0069   234       DO 100 IA=1,23
0070                DO 105 IB=1,(24-IA)
0071                N=N+1
0072                J(N)=0
0073                IGL=IB+IA-1
0074                DO 110 IC=IB,IGL
0075                   J(N)=J(N)+K(IC)
0076   110          CONTINUE
0077   105       CONTINUE
0078   100    CONTINUE
0079          IF(IPAR(3).NE.999)GO TO 422
0080          WRITE( 6,1005) J
0081   C
0082   C  WRITE THE ARRAY OF 276 PERMUTATIONS OUT TO A FILE
0083   C
0084   422    CALL WRITF(IDCB2,IERR,OUBUF)
0085   600    CONTINUE
0086   1005   FORMAT(14(16X,2015,/))
0087   5005   CALL CLOSE(IDCB2)
0088   5000   CALL CLOSE(IDCB1)
0089          WRITE (LU,305)INAM2
0090   305    FORMAT(" FILE "3A2" CREATED")
0091          END

** NO ERRORS**     PROGRAM = 01243      COMMON = 00000
```

LETR

This is an assembly language proceedure utilized by the programs FORMS and PLOTS. It converts the numerical code of each bone-group to an alpha-numeric designator consisting of the beginning and ending vertebrae.

```
0001                    ASMB,R,L
0002  00000                     NAM LETR,7
0003                            ENT LETR
0004                            EXT .ENTR
0005*
0006  00000             AREG    EQU 0
0007  00001             BREG    EQU 1
0008*
0009*
0010* CALLING SEQUENCE:
0011*    CALL LETR(LOCN,INDX)
0012* WHERE LOCN IS THE PLACE TO STORE A DOUBLE WORD (REAL)
0013*  WHICH IS A FOUR CHARACTER ASCII STRING.
0014*
0015*
0016  00000 000000  LOCN    NOP             POINTER TO LOCATION
0017  00001 000000  INDX    NOP             INDEX INTO TABLE OF CHARACTER STRINGS
0018  00002 000000  LETR    NOP
0019  00003 016071X         JSB .ENTR       GET THE ADDRESSES
0020  00004 000000R         DEF LOCN
0021*
0022  00005 162001R         LDA INDX,I      GET THE STRING POINTER
0023  00006 042076R         ADA M1          SUBTRACT 1 FOR FORTRAN INDEXES
0024  00007 001000          ALS             MULTIPLY BY 2
0025  00010 042017R         ADA TABLE       ADD START OF TABLE ADDRESS
0026  00011 072001R         STA INDX        STORE AS POINTER TO CHARACTER TABLE
0027*
0028  00012 104200          DLD INDX,I      GET THE 4 CHAR INDICATED
      00013 100001R
0029  00014 104400          DST LOCN,I      AND STORE THEM IN USERS AREA
      00015 100000R
0030*
0031  00016 126002R         JMP LETR,I      AND RETURN TO THE USER
0032*
0033*
0034                    SUPPRESS ALL THE EXTRA LINES OF PRINTING
0035*
0036  00017 000020R TABLE   DEF *+1
0037  00020 020103          ASC 24, C2  C3  C4  C5  C6  C7  T1  T2  T3  T4  T5  T6
0038  00050 020124          ASC 22, T7  T8  T9  T10 T11 T12 L1  L2  L3  L4  L5
0039  00076 177777  M1      OCT -1
0040*
0041                    END
** NO ERRORS *TOTAL **RTE ASMB 760924**
```

STATS

This program reads the files SECSMA and SECSFE and performs the statistical analysis on each bone-group. The data created is placed in the files STATMA and STATFE.

```
0001  FTN4,L
0002        PROGRAM STATS
0003  C
0004  C  RUN WITH --> :RU.STATS.TERM,MA,LOW,HIGH
0005  C       WHERE TERM IS THE L.U. OF THE SESSION TERMINAL
0006  C             MA   IS THE LAST TWO LETTERS OF THE FILE NAMES
0007  C             LOW  IS THE LOWER AGE CUTOFF
0008  C             HIGH IS THE HIGHER AGE CUTOFF
0009  C             THE INPUT FILE IS NAMED SESSMA OR SESSFE
0010  C             AND AN OUTPUT FILE CALLED STATMA OR STATFE IS CREATED
0011  C
0012        DIMENSION IDCB1(144),IDCB2(144),INBUF(278),IPAR(5),SVN(278)
0013        DIMENSION EVN(278)
0014        INTEGER NAM1(3),NAM2(3),OUNUF(30),ISIZ(2),S278,E278
0015        REAL SDS,MEANS,RDATA(2,100)
0016        REAL MEANB,ENEANB,SDB,ESDBG,DCS,ECDS,RGS,ERGS,SDSE,ESDSE
0017        INTEGER DAY(20),PAGE(32)
0018        EQUIVALENCE (OUBUF(1),NAME),(OUBUF(2),I27B)
0019        EQUIVALENCE (OUBUF(3),EMEANB),(OUBUF(5),SDB),(OUBUF(7),ESDBG)
0020        EQUIVALENCE (OUBUF(9),DCS),(OUBUF(11),EDCS),(OUBUF(13),RGS)
0021        EQUIVALENCE (OUBUF(15),ERGS),(OUBUF(17),SDSE),(OUBUF(19),ESDSE)
0022        EQUIVALENCE (OUBUF(24),C1),(LU,IPAR(1))
0023        DATA ISIZ/20,30/,HALF/65536/,E278,S278/278,2*2/
0024        DATA NAM1/2HSE,2HSS,2HMA/,NAM2/2HST,2HAT,2HMA/
0025  C
0026  C  PICK-UP THE TURN-ON PARAMETERS FROM THE USER
0027  C
0028        CALL RMPAR(IPAR)
0029  C
0030        NAM1(3)=IPAR(2)
0031        NAM2(3)=IPAR(2)
0032  C  OPEN THE INPUT FILE
0033  C
0034        CALL OPEN(IDCB1,IERR,NAM1)
0035        IF (IERR.LT.0) GO TO 5000
0036  C
0037  C
0038        CALL LOPEN(IDCB2,ICRR,NAM2,ISIZ,2,5555)
0039        IF(IERR.LT.0) GO TO 5000
0040  C
0041  C MAKE THE ARRAY OF STARTING
0042  C  AND ENDING MARKERS
0043  C
0044        DO 101 L=1,4
0045          DO 102 K=1,24-L
0046            S278=S278+1
0047  102       SVN(S278)=K
0048          DO 103 K=L,23
0049            E278=E278+1
0050  103       EVN(E278)=K
0051  101     CONTINUE
0052  C
0053  C NOW GO THROUGH THE 278 COLUMNS IN THE FILE, ACCUMULATING
0054  C  THE STATISTICAL DATA.
0055  C
0056        DO 400 I278=1,278
```

```
0057          WRITE(LU,1053)1278,NOLF
0058    1053  FORMAT(I3,A2)
0059          IF(BUFF(IBUF2).GT.0) GO TO 500
0060    500   NOLF=BUFF(IBUF2-5)*(2**8)
0061          NOLF=NOLF+BUFF(IBUF2/8)
0062    C
0063    C  DO THE SET-UP STUFF FOR EACH PASS
0064    C
0065          CALL RWND(IDCB1,IERR)
0066          IF(IERR.NE.0)GO TO 5000
0067          N=0
0068          MEANS=0.0
0069    C
0070    C WE WILL NOW LOOP ON THE DATA FILE FOR THE 100 SAMPLES AND
0071    C  SELECT THOSE THAT FALL WITHIN THE AGE WINDOW TO PUT
0072    C    INTO THE DATA ARRAY.
0073    C
0074          DO 580 I1AA=1,100
0075            CALL READF(IDCB1,IERR,INBUF,278)
0076    C
0077    C  NOW DECIDE IF THIS PERSON WAS TOO OLD OR TOO YOUNG TO USE
0078    C
0079          IF ((INBUF(1).LT.IPAR(1)) .OR.  (INBUF(1).GT.IPAR(2))) GO TO 580
0080    C
0081    C THIS IS WITHIN RANGE. SO PUT IT INTO THE DATA ARRAY
0082          N=N+1
0083          RDATA(1,N)=INBUF(1278)/10.
0084          IF (1278.LE.2) RDATA(1,N)=RDATA(1,N)*10.
0085    C
0086    C ACCUMULATE THE MEAN
0087    C
0088          MEANS=MEANS+RDATA(1,N)
0089    C
0090    C
0091    C IF THIS IS FOR COLUMN 1 (AGE) OR 2 (HEIGHT), WE WILL SORT IT
0092    C   INTO GROUPS.  THE AGE GROUPS ARE 1 YEAR INTERVALS, AND THE HEIGHT
0093    C    GROUPS ARE 30MM (3CM) INTERVALS.
0094    C
0095          IF(1278.GT.2) GO TO 500
0096          IF(1278.GT.1) GO TO 510
0097    C
0098          JAGE=RDATA(1,N)-10
0099          CAGE(JAGE)=CAGE(JAGE)+1
0100          GO TO 580
0101    C
0102    510   JHT=(RDATA(1,N)-1400)/30
0103          CHT(JHT)=CHT(JHT)+1
0104    C
0105    580   CONTINUE
0106    C
0107    C
0108    C NOW DIVIDE THE ACCUMULATED MEAN BY NUMBER OF SKELETONS WITHIN
0109    C   THE AGE WINDOW
0110          MEANS=MEANS/N
0111    C
0112    C  NOW FOR THE STANDARD DEVIATION FROM THE MEAN
```

```
0113  C
0114        SDB=0.0
0115        DO 540 IN=1,N
0116        SDB=SDB+(RDATA(1,IN)-MEANB)**2
0117        SDB=SQRT(SDB/(N-1))
0118  550   CONTINUE
0119        SDB=SQRT(SDB/(N-1))
0120  C
0121  C  IF THIS IS GROUP 2 (X2), THE MEAN, SD, AND DATA MUST BE TRANSFERRED
0122  C    TO LOCATIONS FOR USE IN THE REGRESSION COMPUTATIONS.
0123  C     IF IT IS GROUP 1 (X1), THE SORT CONSTANTS MUST BE COMPUTED.
0124  C
0125        IF(I270.NE.1)GO TO 410
0126  C
0127        DUMMY=N
0128        POUT=SQRT(DUMMY)
0129        POUT2=SQRT(2.0*DUMMY)
0130  C
0131  410   PARCS=SDB/POUT2
0132        ERCON2=SDB*POUT
0133  C
0134  C
0135        IF(I270.NE.2)GO TO 420
0136  C
0137  C THIS IS THE HEIGHT DATA, SO SAVE IT
0138  C
0139        MEANS=MEANB
0140        SDS=SDB
0141        ERMEAS=ERMEAN
0142        ESDS=ESDB
0143        DO 550 IN=1,N
0144  530   RDATA(2,IN)=RDATA(1,IN)
0145  420   IF(I270.LE.2)GO TO 440
0146  C
0147  C NOW, SINCE THIS IS DATA FOR A BONE GROUP, START COMPUTING THE
0148  C  VARIOUS FUNCTIONS.
0149  C
0150  C FIND THE PRODUCT MOMENT
0151  C
0152        PM=0.0
0153        DO 560 IN=1,N
0154        PM=PM+(RDATA(2,IN)-MEANS)*(RDATA(1,IN)-MEANB)
0155        PMS=PM*PM
0156  560   CONTINUE
0157        PMS=PMS/(N-1)
0158  C
0159  C COMPUTE CORRELATION COEFFICIENT
0160  C
0161        CCS=PMS/(SDS*SDB)
0162        ETEM=1-ABS(CCS)**2.
0163        POUT=SQRT(ETEM)
0164  C
0165  C COMPUTE THE REGRESSION COEFFICIENT
0166  C
0167        RCS=PMS/SDB**2
0168  C
```

```
0169  C COMPUTE THE STANDARD ERROR OF THE ESTIMATE
0170  C
0171        SDSE=SDS*ROOTT
0172  C
0173  C COMPUTE THE PERCENT ERRORS ON THE ABOVE
0174  C
0175        EPLS=ETEMP/ROOT
0176        EMIS=(SDS*ROOTT)/(SDS*ROOT)
0177        ESAE=(SDSE*ROOTT)/SUMT2
0178        EI=EPLS+EMIS+ESAE
0179  C
0180  C
0181  C NOW WRITE ALL THAT WE HAVE COMPUTED TO THE OUTPUT FILE
0182  C
0183  440   CONTINUE
0184        CALL WRITF(IBCB2,IERR,OUBUF,30)
0185        IF(IERR.LT.0) GO TO 5050
0186  C
0187  400   CONTINUE
0188        WRITE(LU,1413)NAM2
0189  1413  FORMAT(" FILE ",A2," CREATED ")
0190        GO TO 5005
0191  C
0192  C HANDLE WRITE ERRORS
0193  C
0194  5050  WRITF(LU,5051)IERR
0195  5051  FORMAT("WRITE ERROR.  FMGR=",I3)
0196        GO TO 5005
0197  C
0198  C READ ERRORS
0199  C
0200  5060  WRITE(LU,5061)IERR
0201  5061  FORMAT(" INPUT FILE ERROR.  FMGR=",I3)
0202        GO TO 5005
0203  C
0204  C OPEN ERRORS
0205  C
0206  5000  WRITE (LU,5001)IERR
0207  5001  FORMAT (" OPEN ERROR ",I4)
0208  C
0209  C   NOW CLOSE THE FILES AND QUIT
0210  C
0211  5005  CALL CLOSE(IBCB1)
0212        CALL CLOSE(IBCB2)
0213  1200  END(1,0,0,SUMP(0,5))
0214        END
```

** NO ERRORS ** PROGRAM = 07043 COMMON = 00000

PLOTS

This program reads the files SECSMA, SECSFE, STATMA, and STATFE and draws scattergrams showing the data points and regression line for each bone-group.

```
0001  FTN4,L
0002        PROGRAM PLOTS
0003  C
0004  C   CALL USING: RU,PLOTS,,MA OR FE,SBG,EBG
0005  C
0006        COMMON ICOM(170)
0007        DIMENSION LL1(0),LL2(0),LL3(0),LL4(0),LL5(0)
0008        INTEGER NAM1(3),NAM2(3),IPAR(5),INBUF(278)
0009        REAL RGL(100),RHT(100),AS(2),Y(2,3),X(2,3)
0010        INTEGER IDCB1(144),IDCB2(144),SBG,EBG,LABL1(9),LABL2(8)
0011        EQUIVALENCE (LU,IPAR(1)),(SBG,IPAR(3)),(EBG,IPAR(4))
0012        EQUIVALENCE (ASVM,AS(1)),(AEVM,AS(2))
0013        EQUIVALENCE (RC,INBUF(13)),(SDSE,INBUF(17)),(C1,INBUF(24))
0014        DATA NAM1/2HSE,2HCS,2HMA/,NAM2/2HST,2HAT,2HMA/,SAME/9999./
0015        DATA NOLF/6537B/,ISYMB/31/
0016  100   FORMAT("STATURE (MILLIMETERS)")
0017  110   FORMAT("BONE-GROUP LENGTH (MILLIMETERS)")
0018  120   FORMAT("BONE-GROUP")
0019  130   FORMAT("VS")
0020  140   FORMAT("STATURE")
0021  C
0022  C   PICK UP THE OPERATORS INSTRUCTIONS
0023  C
0024        CALL RMPAR(IPAR)
0025        NAM1(3)=IPAR(2)
0026        NAM2(3)=IPAR(2)
0027        IF(IPAR(2).EQ.2HFE)ISYMB=30
0028  C
0029  C   OPEN THE FILES
0030  C
0031        CALL OPEN(IDCB1,IERR,NAM1)
0032        IF (IERR.LT.0) GO TO 250
0033        CALL OPEN(IDCB2,IERR,NAM2)
0034        IF (IERR.LT.0) GO TO 250
0035  C
0036  C   SET POINTERS TO FORMAT STATEMENTS FOR THE PLOT PACKAGE
0037  C
0038        ASSIGN 100 TO L1
0039        ASSIGN 110 TO L2
0040        ASSIGN 120 TO L3
0041        ASSIGN 130 TO L4
0042        ASSIGN 140 TO L5
0043        LL1(0)=L1+3
0044        LL2(0)=L2+3
0045        LL3(0)=L3+3
0046        LL4(0)=L4+3
0047        LL5(0)=L5+3
0048  C
0049  C  INITIALIZE THE PLOT PACKAGE COMMON
0050        CALL MODE(0.1,,1,,1.)
0051  C  SCALE THE PLOT SIZE
0052        CALL MODE(1,1,,,7,SAME)
0053  C  SET PRINT LIMITS FOR X AND Y AND LOCATE GRAPH
0054        CALL MODE(2,8,4,SAME,,6)
0055        CALL MODE(3,11,35,SAME,,5)
0056  C  SET PLOT WIDTH AND HEIGHT
```

```
0057          CALL MODE(7,8,4,9,25,SAME)
0058    C
0059    C <<<<<<  MAIN BODY OF PROGRAM  >>>>>>>>>
0060    C  DO SCATTERGRAMS FOR BG'S AS DIRECTED
0061    C
0062          DO 200 IBG=SBG+2,EBG+2
0063            WRITE(LU,150)IBG,NOLF
0064    150     FORMAT(I3,A1)
0065    C
0066    C       REWIND THE FILE
0067    C
0068            CALL RWNDF(IDCB1,IERR)
0069            IF(IERR.LT.0) GO TO 250
0070    C
0071    C READ IN THE 100 DATA POINTS
0072    C
0073            DO 220 I100=1,100
0074              CALL READF(IDCB1,IERR,INBUF)
0075              IF (IERR.LT.0) GO TO 250
0076              AHT(I100)=INBUF(2)
0077              BGL(I100)=INBUF(IBG)/10.
0078    220     CONTINUE
0079    C
0080    C
0081    C  READ IN THE REGRESSION STATISTICS
0082    C
0083            CALL READF(IDCB2,IERR,INBUF,30,ILEN,IBG)
0084            IF (IERR.LT.0) GO TO 250
0085    C
0086    C  GET THE BONE-GROUP DESIGNATION
0087    C
0088            CALL LETR(ASYM,INBUF(22))
0089            CALL LETR(AEYM,INBUF(23))
0090    C
0091    C  SCAN THE DATA POINTS AND THEN POINT-PLOT
0092            CALL SCAN(BGL,AHT,-100,6440)
0093            CALL NOTE(BGL,AHT,ISYMB,-100)
0094    C
0095    C  PLOT AXES LINES AND LABELS
0096            CALL AXES(31.1,LL2(0),21.0,LL1(0))
0097    C
0098    C  MAKE A CENTERED HEADING
0099    C
0100            IF (ISG.GT.25) GO TO 210
0101            CALL MOVE(4,,2,,167,0)
0102            CALL NOTE(2,92,11.1,AS,4)
0103            GO TO 215
0104    210     CALL MOVE(4,,2,,167,0)
0105            CALL NOTE(2,39,11.1,ASYM,8)
0106    215     CALL NOTE(2,11,10.8,LL3(0),10)
0107            CALL NOTE(3,15,10.5,LL4(0),2)
0108            CALL NOTE(2,5,10.2,LL5(0),7)
0109    C
0110    C  RETRIEVE PLOT X AND Y AXES VALUES TO COMPUTE
0111    C    THE STARTING AND ENDING POINTS FOR THE REGRESSION LINES
0112    C
```

```
0113            CALL MODE(-8,XMIN,DX,DUMY)
0114            CALL MODE(-9,YMIN,DY,DUMY)
0115            XMAX=8.3*DX+XMIN
0116            YMAX=9.4*DY+YMIN
0117            DO 260 I3=1,3
0118              C=C1+SDSE*(I3-2)
0119              X(1,I3)=XMIN
0120              Y(1,I3)=XMIN*RC+C
0121              IF (Y(1,I3).GE.YMIN) GO TO 270
0122              Y(1,I3)=YMIN
0123              X(1,I3)=(YMIN-C)/RC
0124  270         CONTINUE
0125              X(2,I3)=XMAX
0126              Y(2,I3)=XMAX*RC+C
0127              IF (Y(2,I3).LE.YMAX) GO TO 280
0128              Y(2,I3)=YMAX
0129              X(2,I3)=(YMAX-C)/RC
0130  280         CONTINUE
0131  C
0132  C   DRAW THE REGRESSION LINE
0133  C
0134                IF(I3.EQ.2)GO TO 22
0135                CALL MODE(10,255.,SAME,SAME)
0136                GO TO 44
0137  22            CALL MODE(10,-1.,SAME,SAME)
0138  44            CALL DRAW(X(1,I3),Y(1,I3),2,443)
0139  260       CONTINUE
0140  C
0141  C     STORE THE PAGE JUST CREATED IN THE WORK AREA
0142  C
0143              CALL DRAW(0.,0.,1,9000)
0144  200     CONTINUE
0145  C
0146  C     ALL IS COMPLETE, NOW DO THE CALL THAT CAUSES ALL OF THIS
0147  C      TO BE PLOTTED AND THEN CLOSES THE FILES USED BY THE PLOT
0148  C       PACKAGE.
0149  C
0150            CALL DRAW(0.0,0.9999)
0151            GO TO 400
0152  C
0153  C     OPENING ERROR
0154  C
0155  250     WRITE(LU,230)IERR
0156  230     FORMAT(" FMGR ERROR #",I3)
0157  C
0158  C     CLOSE THE FILES
0159  C
0160  400     CALL CLOSE(IDCB1)
0161            CALL CLOSE(IDCB2)
0162            END

** NO ERRORS**    PROGRAM = 01824      COMMON = 00170
```

FORMS

This program reads the files STATMA and STATFE and prints them out in readable format.

```
0001  FTN4,L
0002        PROGRAM FORMS
0003  C
0004  C  RUN WITH: --> :RU,FORMS,,FE OR IA
0005  C
0006        INTEGER IDCB(144),NAM(3),INBUF(30),AS(2),AE(2),IRS(4),IRE(4)
0007        INTEGER IPAR(5),ISEX(4),MALE(4)
0008  C
0009        REAL R13,R17,R24,RS,RE,ARS(2),ARE(2),AR13(2),AR17(2),AR24(2)
0010  C
0011        EQUIVALENCE (INBUF(1),R1),(INBUF(3),R3),(INBUF(5),R5)
0012        EQUIVALENCE (INBUF(7),R7),(INBUF(9),R9),(INBUF(11),R11)
0013        EQUIVALENCE (INBUF(13),R13),(INBUF(15),R15),(INBUF(17),R17)
0014        EQUIVALENCE (INBUF(19),R19),(INBUF(24),R24)
0015        EQUIVALENCE (INBUF(22),ISVN),(INBUF(23),IEVN)
0016        EQUIVALENCE (AS,RS),(AE,RE),(ARS,IRS),(ARE,IRE),(LU,IPAR(1))
0017  C
0018  C     STATIA OR STATTE FILE FORMAT:
0019  C     TYPE 2 FILE. FIXED 30 WORD RECORDS
0020  C
0021  C     WORD    TYPE   NAME          MEANING
0022  C      1 & 2  REAL   MEANB         MEAN OF THE BONE-GROUP LENGTH
0023  C      3 & 4  REAL   ERRMNB        ERROR OF THE MEAN
0024  C      5 & 6  REAL   SDB           STD DEV OF THE BONE GROUP LENGTH
0025  C      7 & 8  REAL   ESDBG         ERROR OF SDB
0026  C      9 & 10 REAL   CCS           COEFFICIENT OF CORRELATION
0027  C     11 & 12 REAL   ECCS          ERROR OF CCS
0028  C     13 & 14 REAL   RGS           REGRESSION COEFFICIENT
0029  C     15 & 16 REAL   ERGS          ERROR OF RGS
0030  C     17 & 18 REAL   SDSE          STD ERROR OF THE STATURE ESTIMATE
0031  C     19 & 20 REAL   ESDSE         ERROR OF SDSE
0032  C     21      INTEGER IDTO         RECORD NUMBER (BONE-GROUP # + 2)
0033  C     22      INTEGER SVN          STARTING VERSION NUMBER
0034  C     23      INTEGER EVN          ENDING VERSION NUMBER
0035  C     24 & 25 REAL    CI           MEAN OF STATURE - RC * MEANB
0036  C     26 - 30                      SPARES
0037  C
0038        DATA NAM/2HST,2HAT,2HMA/,INLP/46/,NLP/50/
0039        DATA ISEX/2HFE,2HMA,2HLE,2HS /
0040        DATA MALE/2HMA,2HLE,2HS ,2H  /
0041  C
0042  C  GET THE OPERATOR'S COMMANDS
0043  C
0044        CALL PMPAR(IPAR)
0045        IF(IPAR(2).NE.2HMA)GO TO 120
0046  C
0047  C  CHANGE THE SEX OF THE PRINTOUT
0048  C
0049        DO 100 I=1,4
0050          ISEX(I)=MALE(I)
0051  100   CONTINUE
0052  C
0053  C  <<<<<  REGRESSION SECTION  >>>>>
0054  C
0055  C OPEN THE FILE
0056  C
```

```
0057  120   NAM1(3)=IPAR(2)
0058        CALL OPEN(ICB1,IERR,NAM1)
0059        IF(IERR.LT.0) GO TO 5000
0060  C
0061  C
0062        DO 180 I278=3,278,INLP*2
0063  C
0064          WRITE(6,1000) ISEX
0065  1000    FORMAT(1H1,11/47X"REGRESSION FORMULAE FOR NEGRO "4A2)
0066          IF (I278.EQ.3)WRITE(6,1001)
0067  1001    FORMAT(51X"(DIMENSIONS IN MILLIMETERS)"2/)
0068          IF (I278.NE.3)WRITE(6,1002)
0069  1002    FORMAT(59X"(CONTINUED)"2/)
0070  C
0071          DO 160 IPGE=I278,I278+INLP-1
0072  C
0073            DO 140 ICOL=1,2
0074  C
0075              IPECRD=IPGE+INLP*(ICOL-1)
0076  C
0077              CALL READF(ICB1,IERR,INBUF,30,ILEN,IPECRD)
0078              IF (IERR.LT.0) GO TO 5000
0079  C
0080              CALL LETR(PS,ISVN)
0081              CALL LETR(PE,IEVN)
0082  C
0083              ARS(ICOL)=PS
0084              ARE(ICOL)=PE
0085              AR24(ICOL)=R24
0086              AR17(ICOL)=R17
0087              AR13(ICOL)=R13
0088  C
0089  140       CONTINUE
0090  C
0091  C
0092              IF(IPGE.EQ.I278) WRITE(6,1004)AR24(1),AR13(1),IRS(1),IRS(2),
0093         C    IRE(1),IRE(2),AR17(1),AR24(2),AR13(2),IRS(3),IRS(4),IRE(3),
0094         C    IRE(4),AR17(2)
0095  1004       FORMAT(2(8X"STATURE = "F7.2" +"F5.2" X ("2(2A2)") (+-) "
0096         C    F5.2,8X))
0097              IF(IPGE.NE.I278) WRITE(6,1005)AR24(1),AR13(1),IRS(1),IRS(2),
0098         C    IRE(1),IRE(2),AR17(1),AR24(2),AR13(2),IRS(3),IRS(4),IRE(3),
0099         C    IRE(4),AR17(2)
0100  1005       FORMAT(2(16X"= "F7.2" +"F5.2" X ("2(2A2)") (+-) "F5.2,8X))
0101  C
0102  C
0103  C
0104  160     CONTINUE
0105  180   CONTINUE
0106  C
0107  C   <<<<< STATISTICAL ANALYSIS SECTION >>>>>
0108  C
0109  C   FIRST -- PRINT THE STATISTICS PERTAINING TO THE STATURE ALONE
0110  C
0111        DO 200 I278=2,278,NLP
0112  C
```

```
0113          WRITE(6,1014)ISEX
0114          IF(I278.NE.2) WRITE(6,1002)
0115          IF(I278.EQ.2) WRITE(6,1010)
0116    C
0117    C  PAGE LOOP
0118    C
0119          IF(I278.EQ.2)NLP=31
0120          IF(I278.NE.2)NLP=41
0121          DO 260 IPGE=1278,1278+NLP-1
0122    C
0123    C
0124            CALL READF(IDCB1,IERR,INBUF,30,ILEN,IPGE)
0125    C
0126            IF(IPGE.EQ.2) WRITE(6,1011) R1,R3,R5,R7
0127            IF(IPGE.EQ.1278) WRITE(6,1012)
0128    C
0129            CALL LETR(RS,ISW1)
0130            CALL LETR(RE,IEW1)
0131    C
0132    C
0133            IF(IPGE.NE.2) WRITE(6,1013) AS,AE,R1,R3,R5,R7,R9,R11,R13,R15,
0134         C                              R17,R19
0135    C
0136            IF(IPGE.EQ.2720) GO TO 281
0137    260     CONTINUE
0138    C
0139    280   CONTINUE
0140    C
0141    281   WRITE(6,1015)
0142          GO TO 5010
0143    C
0144    1010  FORMAT (4/21X"THIS TABLE GIVES THE MEAN AND STANDARD DEVIATION (SD
0145         C) FOR THE STATURE AND BONE-GROUP LENGTHS"/16X"ALONG WITH THE CORRE
0146         CLATION COEFFICIENT (CC), REGRESSION COEFFICIENT (RC), AND THE STAN
0147         CDARD ERROR"/16X"OF THE ESTIMATE (SDE) FOR EACH OF THE BONE-GROUPS.
0148         C  THE ESTIMATED ERRORS OF EACH OF THE ABOVE ARE"/16X"ALSO PROVIDED
0149         C.  ALL MEASUREMENTS ARE IN MILLIMETERS."2/)
0150    1011  FORMAT(10X"STATURE: MEAN = "F7.2" (+-)"F5.2,6X"STANDARD DEVIATION
0151         C= "F5.2" (+-) "F4.2,2/)
0152    1012  FORMAT(10X"BONE-GROUP"6X"MEAN"7X"(+-)"3X"SD"7X"(+-)"7X"CC"5X"(+-)"
0153         C7X"RC"5X"(+-)"7X"SDE"7X"(+-)"/10X110("-"))
0154    1013  FORMAT(11X,2(2A2),6X,F6.2,5X,F5.2,6X,F5.2,6X,F4.2,6X,F3.2,5X,F3.2
0155         C,6X,F5.2,5X,F4.2,3X,F5.2,6X,F4.2)
0156    1014  FORMAT("1"11/47X"STATISTICAL ANALYSIS -- NEGRO "2(2A2))
0157    1015  FORMAT("1")
0158    C
0159    5000  WRITE(LU,1020)IERR
0160    1020  FORMAT ("  FMGR ERROR"I4)
0161    C
0162    C
0163    5010  CALL CLOSE(IDCB1)
0164          END
```

** NO ERRORS** PROGRAM = 01333 COMMON = 00000

APPENDIX B

FEMALE NEGRO DATA SETS

FEMALE NEGRO DATA SETS

THIS APPENDIX LISTS THE 276 VARIABLES GENERATED FROM THE MEASUREMENTS OF THE INDIVIDUAL VERTEBRAE. THE FIRST LINE OF EACH DATA SET CONSISTS OF THE DATA SET NUMBER, AGE, HEIGHT (IN MM), AND VERTEBRAE LENGTHS (IN TENTHS OF MM) FOR EACH INDIVIDUAL SKELETON. THE REMAINING LINES SHOW THE LENGTHS (IN TENTHS OF MM) OF BONE-GROUPS 1 THROUGH 276 AS EXPLAINED IN THE TEXT.

1 43 1510 340 125 130 120 130 130 150 160 170 170 180 185 190 200 210 215 225 240 255 250 260 255 200

340 125 120 120 130 130 150 160 170 170 180 185 190 200 210 215 225 240 255 250
260 250 280 455 240 250 260 280 310 330 340 350 365 375 390 410 425 445 465
485 505 510 515 535 585 305 370 380 410 440 450 500 535 555 570 600 625 650
680 720 745 765 765 795 785 825 830 850 870 880 885 895 905 925 960 1000 1010 1030
1040 1065 1080 1080 1080 1065 775 810 860 910 960 1010 1055 1095 1135 1180 1225 1260 1345 1385
1410 1465 1540 1115 935 980 1030 1050 1145 1205 1250 1305 1350 1405 1455 1505 1545 1595 1655 1700 1765
1745 1785 1815 1880 1745 1815 1900 1970 2045 2110 2190 1615 1455 1515 1565 1665 1745 1030 1905 1985
2070 2150 2230 2300 2380 1705 1640 1705 1705 1875 1930 2005 2145 2240 2320 2410 2485 2580 1980 1830
1905 1985 2080 2185 2295 2400 2190 2500 2665 2765 2170 2930 2115 2210 2315 2425 2560 2650 2750 2850
2945 2974 2240 2330 2435 2500 2600 2800 2910 3005 3115 2580 2450 2555 2675 2811 2939 3060 3165 3285
3425 3515 3125 3560 3645 3895 3765 3005 3815 3975 4025 3940 4005 4280 4220 4560 3175 3301 3440 3575

2 30 1590 335 150 125 130 135 140 165 175 180 180 190 200 205 215 220 230 240 255 270 280 285 290 260

335 150 125 130 135 140 165 175 180 180 190 200 205 215 220 230 240 255 270 280
295 290 280 460 255 295 265 275 305 340 335 360 370 390 405 420 435 450 470 495
525 570 565 575 570 590 305 390 425 440 480 520 535 550 570 590 620 640 665 680
705 705 805 835 855 855 720 570 580 570 615 660 700 725 700 775 810 840 870 885
1015 1075 1090 1090 1125 1135 855 860 905 745 790 840 890 925 955 980 1030 1070 1110 1160
1200 1220 1260 1160 1280 1050 1105 1165 1260 1290 1345 1380 1440 1500 1565 1635 1710 1780 1850 1960
1975 1990 1730 1705 1850 1965 2025 2115 2200 2285 2360 1035 1550 1620 1700 1785 1874 1450 2050 2175
2295 2415 2540 2640 2765 2960 2665 2770 2980 2975 2230 2170 2260 2360 2470 2590 2690 2770 2845 1935
3150 2500 2570 2400 2605 2740 2865 3085 3125 3210 3440 2725 2820 2930 3060 3200 3345 3290 3440 3564
3715 2841 2585 3150 3280 3440 3580 3695 3195 3115 3705 3410 3565 3720 3860 3450 3385 3535 3695 3855
4025 3270 3565 3820 3975 4137 4300 3995 4110 4262 4285 4240 4300 4475 4700 4855

3 39 1556 345 170 120 120 120 130 155 165 170 180 183 190 200 200 210 215 230 230 247 265 280 285 275

345 120 120 120 130 130 155 165 170 170 185 190 200 200 210 215 230 230 245 265
280 285 265 405 240 240 240 290 305 330 355 360 365 375 390 400 410 425 445 460
465 510 545 565 560 585 360 300 370 405 450 480 515 540 555 575 590 610 620 630
665 705 740 780 830 870 905 480 490 525 570 620 670 700 725 765 775 800 825 870
915 970 960 1020 1065 1105 825 610 645 680 740 800 855 890 925 955 985 1010 1055 1095
1130 1165 1230 1305 1360 955 660 810 860 930 985 1045 1090 1125 1165 1200 1245 1275 1330 1395
1470 1525 1580 1110 830 900 1040 1107 1175 1245 1290 1345 1380 1430 1475 1530 1595 1643 1690 1810
1875 1140 1160 1225 1295 1375 1435 1500 1560 1610 1660 1720 1795 1870 1960 2045 1445 1500 1545 1595
1655 1705 1755 1715 1780 1840 1905 1980 2075 2160 2245 1625 1705 1760 1815 1895 1785 1870 1945 2010
2065 2130 2205 2280 2435 1810 1665 1735 1815 1905 2000 2100 2170 2255 2350 2450 2530 2655 2080 1895
1965 2045 2130 2220 2330 2420 2520 2630 2745 2825 2920 2045 2115 2240 2350 2460 2575 2665 2805 2915
3010 2100 2195 2305 2420 2530 2705 2840 2965 3095 3190 2510 2605 2705 2805 2925 2970 3120 3250 3360
2825 2910 2830 2945 3090 3250 3480 3525 3955 2040 3065 3210 3370 3535 3680 3205 3185 3330 3490 3655
3810 3530 3450 3610 3775 3950 3795 3730 3895 4010 4075 4015 4170 4300 4290 4635

4 30 1635 360 125 115 110 115 130 140 150 180 190 190 175 170 185 190 210 240 260 265 275 290 285 300

360 125 115 110 115 130 140 150 180 190 190 175 170 185 190 210 240 260 265 275
290 285 280 485 240 225 225 245 270 290 330 370 380 365 345 365 375 400 450 500
525 540 565 575 590 600 350 340 355 385 420 470 520 560 555 535 530 545 585 640
710 760 800 850 850 855 710 455 470 495 565 600 600 710 735 725 720 720 755 825
900 975 1040 1080 1115 1130 825 595 610 640 715 790 850 885 905 910 910 930 995 1065
1165 1250 1330 1375 1395 950 735 700 825 905 980 1025 1050 1090 1100 1120 1170 1255 1350 1440
1540 1615 1655 1825 805 940 1015 1095 1195 1295 1240 1280 1310 1360 1430 1520 1625 1730 1825 1895
1980 1065 1130 1205 1270 1325 1300 1430 1490 1560 1625 1690 1795 1915 2015 2105 1425 1255 1320 1380
1490 1510 1570 1640 1730 1810 1885 1970 2087 2200 2295 1615 1445 1490 1550 1625 1700 1780 1880 1990
2075 2160 2260 2370 2485 1905 1620 1685 1765 1815 1910 2020 2140 2250 2370 2490 2545 2650 1980 1730
1850 1925 2025 2150 2280 2405 2530 2640 2760 2925 2150 1975 2040 2130 2260 2410 2540 2630 2820 2495
3015 2335 2165 2250 2375 2525 2675 2820 2970 3105 3285 2525 2375 2490 2635 2790 2950 3110 3255 3385
2735 2615 2750 2900 3065 3240 3395 3535 2975 2875 3015 3170 3355 3525 3675 3235 3140 3290 3465 3640
3805 3500 3415 3580 3750 3920 3775 3705 3865 4030 4065 3930 4140 4350 4270 4630

5 90 1657 350 170 120 130 140 150 165 170 170 180 180 190 190 205 205 225 245 270 285 300 290 265 265

350 120 120 130 140 150 165 170 170 180 180 190 190 205 205 225 245 270 285 300
290 265 265 470 240 250 270 290 315 345 340 350 360 370 380 395 410 430 470 515
555 585 590 555 530 530 370 390 420 455 485 505 520 530 550 560 585 600 635 675
740 800 850 875 855 829 720 510 510 585 625 655 685 700 720 740 765 790 825 880
945 1025 1080 1145 1140 1130 860 660 705 750 795 835 865 890 910 940 970 1015 1060 1150
1230 1315 1380 1410 1405 1010 825 875 925 970 1015 1055 1090 1115 1150 1195 1261 1340 1435 1530
1615 1660 1670 1175 995 1045 1145 1150 1285 1240 1285 1320 1375 1410 1530 1625 1735 1830 1880 1920
1985 1155 1225 1295 1345 1395 1450 1490 1515 1620 1710 1815 1925 2025 2085 2145 1515 1515 1595 1675
1765 1850 1920 1715 1790 1890 1955 2115 2215 2290 2220 1695 1525 1595 1665 1740 1805 1880 1960 2040
2125 2205 2285 2400 2555 1875 1715 1795 1870 1940 2030 2125 2220 2345 2475 2605 2670 2775 2905 1955
1990 2065 2170 2275 2395 2515 2640 2760 2880 2995 2256 2110 2185 2280 2415 2545 2680 2815 2950 3070
3175 2260 2315 2420 2540 2685 2830 2980 3105 3240 3295 2665 2540 2665 2815 2970 3130 3270 3370 3455
2850 2705 2855 3100 3270 3420 3535 3655 3745 3825 3820 3400 3560 3695 3880 3405 3340 3520 3690 3825
3950 3690 3640 3810 3995 4020 3990 3850 4075 4220 4200 4105 4340 4545 4460 4810

6 29 1600 360 135 130 130 130 130 155 170 180 180 190 190 190 200 200 210 225 240 260 270 280 270 280

360 135 130 130 130 130 155 170 180 180 190 190 190 200 200 210 225 240 260 270
280 270 280 405 265 260 260 260 295 325 350 360 370 380 380 390 400 410 435 465
500 550 550 550 550 625 395 345 390 415 455 505 540 560 560 570 580 590 610 630
675 720 770 810 820 830 795 525 520 545 585 635 680 720 740 750 770 780 800 835
875 955 995 1000 1080 1180 805 655 675 715 765 815 875 910 950 950 970 900 1025 1075
1135 1200 1275 1320 1360 1015 810 845 895 945 1000 1065 1100 1130 1150 1180 1215 1265 1335 1405
1485 1545 1680 1170 980 1825 1075 1130 1195 1255 1300 1330 1360 1400 1450 1525 1605 1685 1755 1825
1340 1160 1205 1260 1325 1385 1455 1500 1040 1585 1645 1715 1795 1885 1955 2035 1520 1740 1795 1855
1515 1585 1655 1710 1765 1825 1905 1985 2075 2155 2235 1700 1930 1585 1645 1715 1785 1855 1935 2005
2085 2175 2255 2345 2435 1800 1720 1775 1845 1915 1995 2050 2175 2265 2265 2455 2535 2625 2680 1910
1975 2045 2125 2220 2330 2435 2535 2635 2725 2815 2270 2110 2175 2255 2350 2460 2590 2705 2815 2935
3005 2470 2410 2485 2480 2590 2720 2000 2985 3085 3185 2670 2520 2610 2720 2850 2990 3140 3265 3365
2880 2740 2850 2580 3120 3270 3410 3550 3105 2985 3110 3250 3400 3540 3690 3345 3245 3380 3540 3670
3020 3605 3515 3660 3800 3950 3875 3795 3930 4080 4155 4065 4210 4425 4545 4705

7 22 1740 360 125 130 130 135 150 170 170 170 190 185 190 190 195 200 210 225 240 270 275 280 285 280

360 125 130 130 135 150 170 170 170 190 185 190 190 195 200 210 225 240 270 275
280 285 280 485 255 260 265 285 320 340 340 360 375 375 380 385 395 410 435 465
510 545 555 505 585 615 385 345 415 455 490 510 530 545 565 565 575 585 605 635
675 735 785 825 840 845 745 520 545 585 625 660 700 715 735 755 760 775 795 830
875 945 1010 1065 1115 1120 880 670 715 755 795 850 885 905 925 950 960 985 1020 1070
1145 1220 1290 1350 1390 1050 840 885 925 985 1035 1075 1095 1120 1150 1170 1210 1260 1340 1420
1500 1575 1630 1200 1010 1055 1115 1170 1225 1265 1290 1320 1360 1395 1450 1530 1615 1700 1785 1855
1370 1180 1245 1300 1360 1415 1460 1490 1530 1585 1635 1720 1805 1895 1985 2065 1540 1370 1430 1490
1550 1610 1660 1730 1795 1825 1905 1995 2085 2150 2265 1730 1555 1620 1680 1745 1810 1870 1925 1995
2075 2180 2275 2370 2460 1915 1745 1810 1875 1945 2020 2095 2165 2265 2370 2460 2560 2650 2105 1535
2005 2075 2155 2245 2335 2435 2540 2650 2745 2840 2295 2130 2205 2285 2380 2485 2605 2710 2820 2935
3025 2480 2580 2415 2510 2620 2755 2880 2990 3105 3215 2690 2540 2640 2750 2890 3030 3160 3275 3385
2980 2765 2880 3020 3165 3310 3445 3555 3125 3005 3150 3290 3445 3595 3725 3365 3275 3420 3575 3730
3870 3635 3550 3705 3860 4010 3910 3030 3990 4140 4190 4115 4270 4475 4595 4755

8 49 1631 370 140 130 130 130 145 160 170 175 180 180 190 190 190 200 210 235 260 280 290 300 300 300

370 140 130 130 130 145 160 170 175 180 180 190 190 190 200 210 235 260 280 290
300 300 300 510 270 260 260 270 305 330 345 355 360 370 380 390 410 445 465
540 570 590 600 630 640 400 390 405 435 475 505 525 545 560 570 580 600 615
705 775 830 870 890 900 770 530 535 565 605 650 685 705 725 740 750 770 790 835
905 985 1065 1130 1170 1130 900 970 635 725 790 830 865 895 915 930 950 980 1025 1095
1185 1275 1365 1430 1470 1040 835 960 910 960 1010 1055 1085 1105 1130 1160 1215 1285 1375 1475
1575 1665 1760 1205 1095 1040 1000 1140 1200 1245 1275 1305 1340 1390 1420 1565 1665 1775 1875 1945
1515 1580 1650 1705 1760 1820 1900 1980 2070 2155 2235 1700 1930 1585 1645 1715 1785 1855 1935 2005
2085 2175 2255 2345 2435 1800 1720 1775 1845 1915 1995 2050 2175 2265 2265 2455 2535 2625 2680 1910
1975 2045 2125 2220 2330 2435 2535 2635 2725 2815 2270 2110 2175 2255 2350 2460 2590 2705 2815 2935
3005 2470 2410 2485 2480 2590 2720 2000 2985 3085 3185 2670 2520 2610 2720 2850 2990 3140 3265 3365
2880 2740 2850 2580 3120 3270 3410 3550 3105 2985 3110 3250 3400 3540 3690 3345 3245 3380 3540 3670
3020 3605 3515 3660 3800 3950 3875 3795 3930 4080 4155 4065 4210 4425 4545 4705

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1305	1210	[illegible]	1310	[illegible]	[illegible]	1310	1550	1380	1610	1670	1710	1650	1940	2035	2125	1505	[illegible]	[illegible]	1510
[illegible]	1650	1710	1760	1800	1860	1945	2050	2140	2240	2325	1775	1505	[illegible]	1710	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2125	2205	2340	2440	2530	1960	1705	1840	1915	1985	2060	2140	2230	[illegible]	2425	2525	2640	[illegible]	2100	[illegible]
2070	2115	[illegible]	[illegible]	2500	[illegible]	2615	2715	2025	2930	2360	2190	2250	2325	2415	2530	2660	[illegible]	2995	[illegible]
[illegible]	2525	2390	[illegible]	2045	2660	2805	2955	3085	3205	3305	2765	2800	2800	2795	2940	3095	[illegible]	[illegible]	3195
[illegible]	2800	2950	3045	3250	3305	3545	3675	3185	3040	3285	3360	3320	3605	3035	3445	3345	3490	3650	3030
[illegible]	3700	[illegible]	3725	3850	4110	4010	3925	4085	4740	4290	4225	4325	4600	4515	4830				

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[illegible]	[illegible]	1910	2000	2100	2210	2330	2445	2570	2695	2030	1860	1940	2070	2190	2295	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	2020	[illegible]	2230	2345	2485	2625	2700	2800	3015	2290	2240	2340	2455	2575	2750	[illegible]	[illegible]	[illegible]
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3920	3640	3560	3725	3880	4040	3930	3840	3955	4155	4200	4110	4270	4470	4385	4745					

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255	259	235	405	230	235	240	255	285	310	325	345	345	359	365	365	365	385	420	450	
480	500	505	585	535	580	350	355	375	405	445	475	495	515	525	540	545	550	565	605	
650	700	730	795	755	790	700	470	480	525	565	610	645	670	680	710	720	730	750	785	
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1960	2065	2175	2295	2305	1775	1685	1775	1740	1815	1885	1970	2060	2160	2260	2360	2440	2515	2600	2680	
2760	1975	2085	2205	2330	2580	2580	2580	2580	2580	2580	1970	2080	2175	2275	2385	2490	2595	2690	2780	
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